THURSDAY, NOVEMBER 16, 1876

FOSTER'S "ELEMENTARY PHYSIOLOGY"

A Course of Elementary Practical Physiology. By M. Foster, M.D., F.R.S., Fellow of and Prælector in Trinity College, Cambridge, assisted by J. N. Langley, B.A., St. John's College, Cambridge. (London: Macmillan and Co., 1876.)

IN this little book Dr. Foster gives us the results of his experience in teaching physiology practically to students. As may be readily understood, such teaching is attended with much greater difficulties than those encountered in the experimental teaching of chemistry or of physics—difficulties which arise partly out of the complexity of the phenomena to be demonstrated, partly from the circumstance that experiments in which living processes are concerned cannot be repeated so frequently as would be desirable. Dr. Foster has himself been remarkably successful in overcoming these difficulties. The evidence of that success is to be found in the number of men whose names are already known as efficient workers in physiology, who owe to his teaching their first introduction to scientific research. On this ground, even more than on that of his long experience as a teacher, his opinion on the question of method is more worthy of attention than that of any other person. The book is entitled "A Handbook of Practical Physiology." Our readers are probably not aware that during the last half-dozen years that term has acquired a special meaning. Under the term Practical Physiology all students of medicine are now required by the examining Boards to go through a course of laboratory instruction, for which accordingly arrangements are made in all medical schools. In very many instances the instruction is purely technical and anatomical. All that is attempted is to teach the student "how to work with the microscope," which means for the most part how to prepare tissues for microscopical examination. The acquirement of this art, although, it need not be said, of great value to the physiologist, is not the end and purpose of physiological teaching. The physiologist interests himself only in what is living, and when he uses the microscope, concerns himself with the anatomical structure of a part or organ, only in relation to its living properties.

The handbook contains no description of the microscope, and the subject of microscopical manipulation is dealt with in an appendix. In this respect it differs from most previously published works on histology. Nevertheless it is as good an introduction to that subject as the beginner in animal physiology can take in hand. The plan of study laid down is anatomical, but in carrying it out, the principle is acted upon that it is desirable from the first to give meaning and interest to the otherwise dry details of anatomy, by combining the study of the function of every part with that of its structure. Histological work, says Dr. Foster in his preface, "unless it be salted with the salt either of physiological or of morphological ideas, is apt to degenerate into a learned trifling of the very worst description." To avoid this evil, of which the feebleness of English microscopy is the best evidence, Dr. Foster encourages the student, as soon as he has learnt the anatomy and histology of a part, to pass at once to its physiology, "so that by learning what is known concerning its action, he may form an opinion of the real importance of its structural details."

Let us now see how the principle is carried out. The book comprises twenty-nine lessons. The first is entitled, "Dissection of a Rabbit and of a Dog." The purpose of this introductory lesson is to make the student acquainted with the general construction of the body of the mammalian animal as a whole, a sort of knowledge which students of human anatomy are often strangely wanting in. Then follow two lessons on the blood. In the first, the student learns all that relates to the structural elements of the circulating fluid; but even here the instruction given is of such a nature that he cannot fail to be impressed, provided that he is capable of being impressed by observation, with the fact that he has to do, not with dead forms, but with living organisms. In the second lesson on the blood, the chemical constituents of the *liquor sanguinis* are dealt with, particularly those which are concerned in the process of coagulation. Here necessarily, the microscope and scalpel are for the moment replaced by methods and instruments borrowed from the chemical laboratory, but they are resumed in lessons four and five for the study of cartilage, bone, teeth, and the connective tissues. In the next series of lessons on contractile tissues, structure and function are again mixed. The student, as soon as he knows what cilia and muscular fibres are like, at once proceeds to find out for himself, though according to a prescribed order, how they work. He familiarises himself in succession with the effects of the voltaic current, of single induction shocks, and faradization on living muscle, then proceeds to the more minute examination of the mechanical phenomena of muscular contraction, and finally, as in the previous study of the blood, investigates the same phenomena in their chemical relations.

In the same style and on the same principle each successive subject is dealt with. "The animal body is regarded," to quote the author's words, "as a collection of fundamental tissues, each having a conspicuous property or properties."

Each lesson has appended to it a list of subjects for demonstration by the teacher, these consisting either of microscopical structures requiring very high powers for their exhibition, or of experiments which the student would be unable to perform for himself. Among these last only such are comprised as are in their nature painless.

There can be no doubt that the book is admirably adapted for its immediate purpose, namely, for the instruction of natural science students at Cambridge. In order to judge of its general utility the question must be asked whether it is adapted to the requirements of the much larger class of students who learn physiology with a view to the study of medicine.

The answer to this question must depend on the class of medical students contemplated. Students of medicine may be divided into three categories, the first comprising those who come up with the avowed intention of acquiring no more than the minimum of cram exacted of them by the Examining Boards, and who at the end of their time are as incompetent for practice as they are destitute of knowledge. The second, and by far the largest class,

made up of men who, while they desire to acquire by assiduous reading as much so-called medical science as is thought necessary for them to possess, rightly regard it as their principal duty to devote their energies during their brief period of study to the attainment of skill and experience in the arts of medicine and surgery. But besides these, there is a smaller class of men who not only have time for real study, but possess the necessary previous education in which their fellows are in general so deplorably wanting, and whose motive for work is something higher than that of preparing themselves for examination.

To medical students of this last class the lessons are perfectly adapted. Nor can we conceive that a better course could be followed by a young man intending to fit himself for the higher career of the medical profession, than that laid down by Dr. Foster, namely, that he should at a very early period, *i.e.*, while he is still engaged in the study of the more exact branches of natural science, first work through the course of elementary biology laid down for him in the well-known lessons of Professor Huxley; then that he should devote a considerable proportion of his time during a subsequent year to becoming conversant with the structures and processes peculiar to the bodies of the higher animals, under the guidance of a teacher who must be a real physiologist—all this being accomplished before he begins his proper medical studies, *i.e.*, before he begins to study the details of human descriptive anatomy.

Strange as it may seem, it is not yet sufficiently recognised by those who are concerned in medical education that the men on whom the community depends for enlightenment on the great questions of the preservation of health and the prevention of disease, ought to be practically familiar with all that is known concerning living processes. The remark is frequently made that even to the consulting physician or to the officer of health, physiology and pathology are of relatively little value. Surely this must be a mistake. It may be readily admitted that the ordinary practitioner needs only familiarity with the characteristics of human ailments and the prescribed methods of treatment and skill in the handling of sick people, and may well content himself with as much of the elements of scientific knowledge as he can learn from manuals and lectures; but surely the education of those who are intended to be advisers of the public in relation to health and disease should have some more solid foundation. There can be no question that these men ought to be prepared for their higher functions and responsibilities by such a course of preliminary work in physiology as will enable them, if so be that nature has fitted them for it, to enter with some hope of success on those most difficult of all biological investigations which relate to the nature and causes of diseases.

BRITISH MANUFACTURING INDUSTRIES

British Manufacturing Industries. Edited by G. Phillips Bevan, F.G.S. "Salt, Preservation of Food, Bread, and Biscuits," by J. J. Manley, M.A.; "Sugar Refining," by C. Haughton Gill; "Butter and Cheese," by Morgan Evans; "Brewing, Distilling," by T. A. Pooley, B.Sc., F.C.S. (London: Edward Stanford, 1876.)

THE preface states that in these volumes, of which the present is one, "the facts are gathered together and presented in as readable a form as is compatible with accuracy and a freedom from superficiality; and though they do not lay claim to being a technical guide to each industry, the names of the contributors are a sufficient guarantee that they are a reliable and standard work of reference."

This editorial explanation fairly describes the scope of the articles contributed by their respective writers to this volume; since, while not pretending to be a technical guide to each industry, they must prove of great value to all desiring to obtain a *general* knowledge of the processes described. The common fault of encyclopædias of this kind is to devote much space to detailed explanations of manufacturing processes and of the machinery employed. To the ordinary reader all such elaborate details are useless, since his object is to obtain information upon the general principles upon which the various processes are based; and to the manufacturer practically engaged in any process they are equally useless, since no matter how carefully written, they can teach him nothing, because, as a matter of course, he is in advance of the processes described with so much detail.

The first article is an interesting account of "Salt,' where found, and how manufactured from the crude deposit. Some valuable statistics are given as to the quantity produced in and exported from England.

The next article on the "Preservation of Food" by the same contributor deals with a subject of increasing importance. Though there has been an important increase, of late years, in the amount of green crops, and in land laid down to grass in the United Kingdom, yet the consumption of beef and mutton has so spread among the working classes, as to render the increased production vastly inadequate to the ever-increasing demand. It has become in consequence a matter of the highest importance to discover means by which animal food may be imported from America, Australia, and other countries where it is abundant.

The chief processes hitherto employed for the preservation of meat are classified by the author under the heads of Drying, Action of Cold, Chemical Reagents, and Exclusion of Air. The drying process has certainly not proved a success. "Charqui," so much praised a few years since, is but a poor substitute for fresh animal food.

The value of ice in preserving meat in cold countries is so well established, that it naturally presents itself as a convenient agent. Hitherto, however, as regards great distances, it has failed. This has arisen from two causes: in the first place the temperature of melting ice is not low enough to prevent change even on ship board; this difficulty will doubtless be overcome by the employment of machines, by which a temperature lower than 0° C. can be maintained at sea. Another difficulty has arisen from the fact that meat kept at the temperature of melting ice is very prone to change so soon as removed from the ice-tanks to be distributed throughout the country. Doubtless in time these and other difficulties will be removed, and our large cities, at least, be supplied with regular arrivals of fresh uncooked meat from South America and our colonies.

The use of chemical reagents has hitherto proved inefficient, but we cannot agree with Mr. Manley "that it is hardly likely that the use of chemicals will solve the question of meat preservation." A patent has lately been granted by which oxygen-absorbing reagents are so suc-

cessfully applied as to give some hope that this or some other chemical process will aid us in this important question.

The author gives some useful details and statistics regarding the "tinned meat" process. This well-known method depends upon the exclusion of air by the substitution of steam, and in the consequent destruction of organic germs. So far as mere preservation is concerned, it has undoubtedly proved a great success, and has already been of some benefit to us; but the long cooking process hitherto employed to expel the air has so destroyed the texture of the meat as to have rendered its use unpopular in spite of the efforts of enthusiasts to force the over-cooked product upon an unwilling public. So soon as the very primitive plan of heating the tins in a bath of chloride of calcium for three or four hours be replaced by one exhausting the air and replacing it by steam at a high temperature successively, and occupying no more than half an hour, then will the tinned meat process prove a real success, and possess many advantages over all others. Mr. Manley has done good service by his description of what has been attempted, and though he suggests but little himself, he may induce some of his readers to experiment upon a matter of such national importance.

The paper on "Sugar Refining" is one of the best contributions in the series, written by one not only an able chemist but also a thoroughly practical sugar refiner. As a clear, accurate, and scientific exposition of an important industry it serves as an example of what such contributions should be. Its only fault is that it is somewhat too brief. After the usual historical account of the industry, the author explains the more important properties of sugar, and shows how these are made use of in the various stages of extraction and purification from the cane and the beet. The author has not considered it within his province to refer to the serious injury to our sugar manufacturers by the heavy export premiums paid by the French nation on all high class products exported to this country. Doubtless so soon as the French financiers have completely extinguished the manufacture of loaf and other high class sugars in England, they will then remove the export premiums, being full well assured that the memory of the ruined English sugar refiners will for a long time at least deter our capitalists from competing with French refineries. Though the "beet" produces one-third of the total amount of sugar grown, and has proved of such value to agriculture on the Continent, yet hitherto the growth of beets for sugar manufacturing purposes has not proved a success in our own country. Nor indeed is it likely to prove remunerative so long as it pays better to grow beef and mutton. In concluding this brief notice we cannot refrain from once more praising the author's valuable—though brief—contribution.

Mr. Evans contributes a short article on dairy produce. He gives some interesting information upon the factory system of cheese-making introduced with so much success into England within the last few years. It is to be regretted that Mr. Evans has given no information upon the mode of preparing the French, Italian, and Swiss heeses so much appreciated by connoisseurs.

The article on "Brewing and Distilling" is a useful contribution on two important industries, by one evidently well acquainted with them. Some valuable statistics are given, showing the vast development which has taken place in the production of alcoholic beverages in the United Kingdom. According to the author, on March 31, 1873, there were 31,010 brewers, 144,425 dealers and retailers of beer. The income derived from beer in 1873 amounted to 8,027,408*l.*, a sum which fully explains the hesitation of the present Government to please the agricultural interest by the removal of the malt-tax. In addition to these thirty thousand brewers, of whom, however, only some three thousand are licensed common brewers—there are, it appears, 318 distillers and rectifiers, producing 30,644,750 gallons of spirit, yielding a revenue of 14,895,769*l.*; the number of licences issued in 1875 to persons dealing in and retailing spirits was 138,845. The author calculates that in the brewing and distilling industries, and in those originated and sustained by them, there is a capital of two hundred millions invested. Without following Sir Wilfrid Lawson in all his statements, one cannot but view an annual consumption of twenty-eight to thirty millions of gallons of spirit as a most serious feature in our social life.

Those interested in this matter and desirous of obtaining a general knowledge of the technical processes, will with advantage consult Mr. Pooley's articles. In concluding this notice of the volume before us we must congratulate the publisher and the editor on their success in obtaining the aid of writers so well acquainted with their respective subjects.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Sea Fisheries

MR HOLDSWORTH, at the close of his animadversions (NATURE, vol. xv. p. 23) on the address I recently delivered in the Biological Section of the British Association at Glasgow, says that he does not know on what evidence I grounded my belief in the decline of our sea-fisheries. I am therefore anxious to state that the evidence to which I trusted in what I then said was mainly, if not entirely, that collected by the Royal Commission of which he was the hard-working secretary. The kindness of my good friend in giving me private notice of his intention to make his comments public enables me the more promptly to furnish a reply to them, and for so doing he has my best thanks.

I do not pretend to have read through the whole of the 1,500 and odd somewhat closely-printed folio pages which form the two "Blue-books" embodying the labours of that Commission. But soon after they appeared—about ten years ago—I looked into them sufficiently, as I thought, to give me a fair notion of their contents. Whether that notion was mistaken your readers will be better able to judge by the time I have done. When I wrote my address I had not these books by me. I have since refreshed my memory by consulting them. I find that deep as was the impression left by my first examination of them it is now still deeper, and were I to write my address over again I should express myself in far stronger terms.

The second and most bulky volume of these blue-books contains the "Minutes of Evidence" taken before the Sea Fisheries Commission, and reports the 61,831 questions and answers put by or given to the Commissioners. At first the attempt to find the particular needles one may be seeking in this immense bottle of hay seems hopeless. But fortunately the volume (as most blue-books are) is furnished with a copious index, extending to 29

pages folio, and by help of this I beg leave to submit to Mr. Holdsworth and your readers the following results.

The Commissioners took evidence at eighty-six places (Billingsgate and London counting separately), which, for convenience' sake, I will call "stations." Now it appears that of these eighty-six stations evidence was offered at twenty-two, showing an *increase* in the supply of fish generally, and evidence showing a *decrease* at forty-three, or exactly half of the whole number. But at thirteen of these stations the evidence was conflicting. Deducting, therefore, that number from each side, we have thirty stations where the evidence was solely for the decrease and only nine for the increase, or a clear majority of twenty-one stations for the former. It also appears (unless my arithmetic is at fault) that of the answers given to the Commissioners at these several places 250 showed an increase, and 605 a decrease. If, then, my opinion on this subject is so erroneous as Mr. Holdsworth asserts, it is one entertained by a good many people who know more of fishery matters than I do.

If, further, we analyse the evidence as to various kinds of fishes the results will not be very different. These will be best stated in a tabular form.

Kind of Fishes.	No. of Stations showing					
	Increase.	No falling off.	Decrease.	Total Disappearance.	Conflicting Evidence.	Clear Majority for Decrease.
Bream	1	—	—	—	—	—
Brill	—	—	2	—	—	2
Cod and Ling ...	9	—	42	—	5	38
Dogfish	—	—	2	—	—	2
Haddock	12	—	40	10	4	38
Hake	1	—	13	—	—	12
Halibut	—	—	2	—	—	2
Herring	24	—	41	—	13	17
Ling	1	—	8	—	1	7
Mackarel	4	—	11	—	2	7
Megrim	—	—	—	1	—	1
Pilchard	3	—	1	—	—	—
Plaice	3	—	2	—	—	—
Pollack	—	—	—	3	—	3
Skate	—	3	—	—	—	—
Smelt	—	—	2	—	—	2
Sole	6	—	15	—	2	9
Sprat	3	—	6	—	1	3
Turbot...	7	—	9	—	—	2
Whiting	6	1	11	—	—	4

Thus out of these *twenty* kinds, *sixteen* show a positive decrease at more or fewer stations, and among them are some of the most important of our "food fishes"—cod and ling, haddock, hake, herring, mackarel, sole, sprat, and whiting.

Now I can imagine *three* objections being raised to the obvious inference from this table :—

First: that the witnesses for the decrease were untrustworthy.

Secondly: that the Irish stations are included among those showing decrease, and Irish fisheries are said to be languishing from causes which do not concern the present matter.

Thirdly: that even the non-Irish stations showing decrease are comparatively small and unimportant.

1. Without imputing any want of veracity to the witnesses for the decrease it is obvious that, as all fishermen have a pretty hard time of it, the proportion among them with a despairing turn of mind may be greater than among men who follow other callings, and that this may unconsciously tinge their testimony. So far, however, as my own experience goes, which is perhaps a very little way, I have found that the grumblers among fishermen commonly assign some specific cause for their complaints—be that cause real or imaginary. If so-and-so were or were not the case, they say, they would get on very well. Their assignment of any cause is purely a matter of opinion with them. Their statements as to the increase or decrease of fishes relate to a matter of fact within their own knowledge.

2. The proportion of Irish to non-Irish stations among those which show decrease is by no means excessive. Here it is :—Cod and ling, 13 out of 42; haddock, 12 out of 40; hake, 5 out of 13; herring, 10 out of 41; mackarel, 2 out of 11; sole, 1 out of 15; sprat, 1 out of 6; whiting, 1 out of 11. If the Irish stations were wholly disregarded the general deduction would not be materially affected.

3. Any one who has ever tried to learn the facts attending the process of extinction of animals, will soon find that the premonitory symptoms of approaching extirpation may be for a long time hardly recognisable at places where the particular species concerned is most abundant. It is first cut short on its borders, and scarcity begins and is most readily perceived at its outlying localities. Hence it is exactly in accordance with what always, or almost always happens, that the smaller and least important fisheries should first show signs of decline, if such decline is going on, as the above figures seem to prove. It may be years before the great trawling-grounds on various parts of the coast, or the Dogger Bank and the Silver Pit show unmistakable signs of exhaustion, but where is the take of fish inshore increasing or even stationary?

Having thus furnished the main grounds of my belief—for I do not wish to rely on the Report of the Committee of the House of Commons in 1833 (though that declared the Channel fisheries to have been in a declining state since 1815) further than to show it is a belief of long standing and held by practical men—I must proceed to make some other remarks on Mr. Holdsworth's indictment. First of all let me admit that he is of course literally accurate in his statement of the particular objects for which the Royal Commission of 1863 was appointed. But, as he also rightly remarks, its inquiry was extended, and indeed no one can glance at its blue-books without seeing that the inquiry covered far more ground than ever was scraped by a trawl. As I read the Instructions to the Commissioners, they were wide enough to permit any sort of inquiry into British Fisheries—even the seeking of a remedy for any decline in them if such was found to exist. But since my friend takes refuge behind the literal wording of the Queen's Commission, I may do the same with regard to the expressions used in my address. No doubt had I had the blue-books by me when I was writing I should have been more explicit in separating the Commission in which he acted as secretary from others that had preceded it. But, as it is, my words, reprinted in your own columns (NATURE, vol. xiv. pp. 440, 441), show that I spoke of it as something distinct from them, and so it truly was, for as Mr. Holdsworth himself says, it was "the most comprehensive investigation of the subject that had ever been made," and the evidence it collected is one of the most valuable contributions to applied zoology with which I am acquainted.

Next there comes up another point. It is quite compatible with an increased *supply* of fish that there may be an actual decrease in the *stock* of fishes, and it seems to me that my critic hardly sees the danger of confounding these two very different things. That the supply of fish to our markets has of late enormously increased may be indubitable—the question really is whether there are still in our seas as many fishes as there used to be. The evidence I have above analysed shows, I think, that there are not, and the recommendations of the Commissioners of 1863 are certainly not such as would increase the number.

Mr. Holdsworth asserts that "practical mischief is likely to result" from my opinions becoming known to fishermen. I wish he had been a little more careful to explain wherein the danger lies. Unless it be that the next Sea-Fisheries Commissioners may find their inquiries suddenly stopped by a well-placed torpedo, I am at a loss to imagine the risk. As, however, their permanent brethren of the Rivers Commission continue to pursue their duties without any such unpleasant consequences, I think the possible mischief must be over-rated. Mischief may arise, though, from the utterance of smooth sayings, and very great mischief too; but, if it does, it will not attach to those that utter the note of warning. My friend refers to his "Deep-sea Fishing and Fishing-boats," an excellent work in many respects, which fully deserves all that was said in its praise in your columns when it appeared (NATURE, vol. xi., p. 421), and perhaps more, for the reviewer did declare that the author's "inferences and his facts are very much at variance," which was perhaps going rather too far. I have carefully read it, but I fail to find there any new facts—new, I mean, since the publication of the blue-books before-mentioned—that bear out his views of the matter. On the contrary, I have met with several admissions which I think point in the opposite direction. Thus I read of Yarmouth (p. 111) :—"The mackarel 'voyages,' however, have been so unprofitable during the last few years that there is little inducement to invest very largely in new gear for that fishery."

A little further on, of Lowestoft (p. 122):—"Recent experience, however, does not support this statement" [that the summer fish are often as abundant as they ever were before the spring-fishery came into fashion], "as with a more or less successful series of spring fisheries, the summer herrings have been exceedingly scarce for the last seven years." Now neither Yarmouth nor Lowestoft are very small or unimportant stations. It would look, then, as if scarcity has begun to appear there. Again (pp. 214, 215), Mr. Holdsworth tells a very good story of the disappearance of herrings from the Guernsey waters; but he does not contradict the statement that there has been no herring-fishery there since the year 1830. Furthermore he says (pp. 266, 267):—"Turbot or 'bratt' nets are successfully worked by the Staithes fishermen, although, according to their report, the catches are not nearly as large as they were formerly. This is the general statement along this coast. . . . It is a remarkable circumstance that nearly thirty years ago turbot became so scarce near North Sunderland, close to Holy Island, that the turbot-nets were given up. At that time trawling in the North Sea was only just beginning from Hull and that part of the coast; and the trawlers have never worked near the place where the decrease of turbot was said to have been greater than even at Staithes. It is evident, then, that we have a good deal to learn about what attracts or drives away the fish to or from any particular locality."

To this last remark I cordially agree, for in my address I said that the consideration of our fisheries is "fraught with unusual difficulties." But while we are satisfying ourselves on this and similar points, I cannot regard with the same complacency as Mr. Holdsworth the increasing outlay of capital in improved boats and fresh fishing-gear, the growing fish-traffic on the railways, or the glories of an enlarged and renovated Billingsgate, arising amid the pious ejaculations of its frequenters. Is that the only market which is to be unaffected by inflation? I derive little comfort in allowing my fancy to run riot over the marble slabs of Cheapside, Bond Street, and Arabella Row, teeming at present with every finny delicacy, and still less when I meet the humble barrow of the East-end costermonger, with its as plenteous and more odorific load. The question is, how long will that abundance last? Incalculably great as the stock of fishes in our seas may be, it must be subject to the same laws as the stock of every other animal. Directly the draughts upon it exceed its natural increase, it must dwindle. The time when that shall happen seems from the evidence before me to be imminent.

Some of Mr. Holdsworth's remarks appear to me irrelevant. I said nothing in my address about "spawning-beds," and therefore to have mentioned the discoveries of Prof. Sars and Herr Malm would have been little to the purpose. But if my friend meant to hint that I did not know that the spawn of some fishes floats in the water during its development, I will content myself by observing that my acquaintance with Scandinavian naturalists and their works began in the year 1855. His reference to the Sea Birds' Preservation Bill also seems to be wide of the mark. But I am sure ornithologists will be thankful to him for information that will show how many of the birds named in that Act commonly prey upon the sea-fishes that come to our markets, and which kinds they take. Perhaps he will also explain why the fishermen of our coasts were so strongly in favour of its being passed. Of the precise direction my efforts took towards that end Mr. Holdsworth, I think, cannot be aware.

ALFRED NEWTON

Magdalene College, Cambridge, November 3

P.S.—If the remarks I made in my address be well founded, they of course have a general bearing, and will apply to all cases of "over-fishing." Since I wrote the above I have received from my kind friend, Prof. Baird, the United States' Commissioner of Tides and Fisheries, his reports from 1871 to 1875. Therein I find the decrease of the Sea-Fisheries on the Atlantic coast of the United States treated as a fact beyond denial, and "over-fishing" unquestionably assigned as the chief cause of that decrease. A. N.

November 14

The Foundation of Zoological Stations in Heligoland and Kiel

WILL you kindly permit me to say a few words in answer to the letter by which my friend Mr. Balfour expressed his view on the proposed foundation of zoological stations at Heligoland and Kiel.

Mr. Balfour has certainly not been well informed, when he believes the promoters of the future stations in Heligoland and Kiel had intended "to put aside claims of the zoological station at Naples in favour of the two new institutions." In the first place it is expressly stated in their Report that the committee are far from wishing to take away the least support from the Naples establishment. Besides, according to information which reached me some time ago, one of the most competent and influential members of the committee has only consented to act, if it is expressly stated in the memorandum to be handed over to Government, "that, should the empire limit its annual contributions to zoological stations to 1,000*l.* or 1,200*l.* (a sum asked at present for the zoological station at Naples), this sum ought to go *undivided* to the Naples establishment as the one of much greater importance. The foundation of the two northern stations ought in consequence to be deferred to later times."

Nothing more than this could be desired, and certainly the proposition once made, nothing more could be expected, and had Mr. Balfour been acquainted with the whole of the facts, I am satisfied he would never have applied the terms "unwise and ungenerous" to the proposition. He is, however, certainly right in maintaining that the Naples station has been the means of proving both the value and feasibility of such institutions, and perhaps nobody, besides myself, knows better than Mr. Balfour, how great and how numerous were the obstacles which had to be overcome. This and the fact that Mr. Balfour assisted me most generously and most vigorously during the whole of my struggle, entitles him fully to disapprove of what he thinks might possibly have a detrimental influence on the fate of the Naples establishment. With regard to this apprehension I may be permitted to state that there is well founded hope that the Naples station will soon be free from such embarrassments as are the consequence of insufficient means, and that I always expected and desired a series of zoological stations to spring up which should not only follow but even rival the original one started by myself. The sudden appearance of zoological stations on the Normandy coast, at Trieste, Sebastopol, the foundation of the late Anderson School of Natural History in the United States, the proposition to create two stations at Heligoland and Kiel, and another plan to erect a station on the White Sea, brought before the Association of Russian Naturalists in Warsaw, furnish indubitable proofs that my belief was well founded. It may be that too little circumspection has been used in founding or planning several of these institutions; nevertheless their great number and rapid augmentation justify me in giving to my establishment such dimensions and so distinct an international character as to carry it as far beyond competition as possible.

I hope to be able to enter more fully into the development of the Naples station in the Second Annual Report, which I think will be ready next spring. It will show that till now the station has not only not suffered from competition but has been increasing very considerably the range of its activity and influence on the progress of biology. ANTON DOHRN

Berlin, November 5

The Deep-sea Manganiferous Muds

IN the very interesting Address delivered by Sir C. Wyville Thomson, at Glasgow, on the *Challenger* expedition, while referring to the "red clay" deposit so general over the deepest parts of the Atlantic and North Pacific, the remarkable fact is mentioned that the clay contains numerous nodules of peroxide of manganese, which in some places are found in great quantity.[1] The Address goes on to say:—"This is a phenomenon which we are as yet unable to explain, and I do not know that there is any analogous instance in any of the older formations" (NATURE, vol. xiv., p. 494).

It is possible that this can be accounted for in the same manner as the formation of the "red clay" itself, assuming that the explanation given by Sir C. Wyville Thomson is the correct one, as there can be but little reason to doubt. It is true that exception has been taken to it by Dr. Carpenter, who considers the "red clay" to be "a *post-mortem* deposit in the chambers of the foraminifera."[2] It does not clearly appear, however, where such a *post-mortem* pseudomorphic deposit could come from in this case, while, were that opinion correct, then the *Globigerina* ooze

[1] See also "Report to Hydrographer of the Admiralty on the Cruise of H.M.S. *Challenger*." Prof. Wyville Thomson, F.R.S., *Proc.* Roy. Soc., vol. xxiv., p. 39.

[2] "Remarks on Prof. Wyville Thomson's Preliminary Notes on the Nature of the Sea-bottom," &c., *Proc.* Roy. Soc., [vol. xxiii., p. 244.

itself ought also to form a pseudomorphic deposit of the same kind.

Accepting, then, Sir Wyville Thomson's theory, the manganiferous deposit might be accounted for as follows:—

Manganese occurs in sea-water in very small quantities, sufficient, nevertheless, for detection. Forchammer has detected it together with iron and silica; as also have Figuer and Mialhe.[1] It is, besides, almost invariably found in the waters of some springs, according to Prof. T. Sterry Hunt,[2] and spring-water sooner or later finds its way to the ocean. Again, it is found in the ashes of plants,[3] and it is therefore not unlikely that it may be secreted by other organisms, such as foraminifera, molluscs, &c.—in fact, Bischof found in the outer scale of oyster-shells 0·61 per cent. of ferric oxide, with some oxide of manganese[4]—and as its carbonate is isomorphous with that of lime and iron, it is perfectly probable that these should be found associated together, as indeed they usually are. Supposing, then, *Globigerina* shells to consist of carbonate of lime, with small traces of carbonate of iron, carbonate of manganese, peroxide of iron, and silicate of alumina, the following changes might take place while the shell was passing through water charged with carbonic acid gas and oxygen.

All the carbonates would first be dissolved. Then the carbonates of iron and manganese would be oxidised, as they readily part with carbonic acid in presence of oxygen, and the liberated carbonic acid would, no doubt, act on a fresh portion of the mixed carbonates. The silicate of alumina and peroxide of iron already in the shell[5] would not be affected. Thus there would be a continual deposition of silicate of alumina, peroxide of iron, and peroxide of manganese, very likely both hydrated. It is taken for granted here that the red clay is merely a silicate of alumina coloured by peroxide of iron, and not a double silicate of iron and alumina. It does not seem quite clear which is really meant in any of the reports. Alumina is found in small traces in river- and sea-water, perhaps in many cases as the silicate, which is soluble in minute proportions. Or it might originally exist as sulphate, in that state enter into the structure of marine organisms, and subsequently undergo alteration to silicate. Alumina has been found in small quantities in plants, but how combined is not yet known.

I believe the principal deposits of manganese ores are found in connection with limestone or dolomitic rocks, probably for the most part originally disseminated through them in small proportions, and subsequently concentrated in particular localities by the action of infiltrating water, and the nearest approach to the phenomenon described by Sir Wyville Thomson appears to be met with in the associated limestone, dolomite, iron ore, and nodular manganese ore of the Lahn district, as recorded by Bischof.[6] At the place where the iron and manganese beds are worked, there are several clay beds, varying from a few feet to several fathoms in thickness. These Bischof considers are the result of the continuous action of water containing carbonic acid, the argillaceous limestone being converted into clay. The manganese and iron ores lie beneath the clay beds, and it is most likely that these minerals were extracted from the argillaceous limestone at the same time as the carbonate of lime, having doubtless existed in small quantities as carbonates in the organisms forming the mass. In fact the lower clay beds still contain some manganese. There is thus considerable analogy between the two cases, the difference being that these old limestones having been formed in mass, in not very deep water, were not liable to be dissolved—immediately on the death of the organisms whose skeletons they were—by the action of sea-water, that part being played ages afterwards by atmospheric water. The result has been mainly the same, however, viz., the production of clay from the limestone, together with nodular manganese. Possibly had the corals, &c., forming that limestone had the opportunity of falling slowly, and each isolated, through a sufficient depth of sea-water, the result would have been a manganiferous mud, similar to these deep-sea clays.

As to the nodular structure of the manganese oxide, it is of course referable to the same mysterious molecular attraction which determines the segregation of all the carbonate of iron in the case of clay-ironstone in fire-clays and shales, and silica, as in chalk flints.

Since the above was written, the last number of the *Proceedings* of the Royal Society (vol. xxiv. No. 170), with Preliminary Reports on the Cruise of the *Challenger*, by Sir C. Wyville Thomson and colleagues, has come to hand. These reports contain a full description of the manganiferous muds, but no theory as to the origin of the manganese is as yet put forward.

EDWARD T. HARDMAN,
Kilkenny H.M. Geological Survey, Ireland

[1] Bischof, "Chem. Geo.," vol. i., pp. 99-108.
[2] "Chem. and Geo. Essays," p. 143.
[3] Fownes' "Man. of Chem.," p. 469; also Watts' "Chem. Dict."
[4] *Op. cit.*, vol. i., p. 198.
[5] It may be that there is a trace of uncombined ferric oxide already in these shells, since the *Globigerina* ooze, when treated with very dilute acid, leaves a red sediment like the "red clay" (see "The Cruise of the *Challenger*," NATURE, vol. xiv. p. 96). Sir Wyville hesitates to claim for the silicate of alumina and peroxide of iron that they exist in that form in the shells, rather supposing them to be products of alteration. But the latter is certainly found in some shells and in red corals. It has been shown by Prof. A. H. Church that the red chalk of Hunstanton, treated with very weak acid, yields a residue closely resembling the deep-sea "red clay."—*Chem. News*, xxxi. p. 199.
[6] *Op. cit.*, vol. iii. p. 193.

Mr. Wallace on the Distribution of Passerine Birds

IN Mr. Wallace's recently-published work on Geographical Distribution, in more than one place the results arrived at from an inspection of his elaborate tables of genera and families do not agree with the numbers he uses in considering the general bearing of the facts adduced. Thus in his "General Remarks on the Distribution of the Passeres," vol. ii. pp. 299-302, he says (*l.c.* p. 300): "The families that are confined to single regions are not very numerous, except in the case of the Neotropical region, which has *five*, the Australian has only *three*, the Oriental one, Ethiopian one, and the other regions have no peculiar families." Adopting his tables of the families of the Passeres, I find the numbers should be really as follows:—

Neotropical	7	... Fams. Nos.	39a, 40, 41, 42, 44, 45, 46.
Australian	5	... ,, ,,	21, 22, 25, 49, 50.
Oriental	3	... ,, ,,	11, 12, 43.

The Nearctic region should also be mentioned as possessing one peculiar family, *i.e.* Chamæidæ. The statement that none of the turdoid Passerine families are exclusively American must also be modified to meet this fact. There are three families (*i.e.* Paictidæ, Pittidæ, Eurylæmidæ), instead of *two*, of the Formicaroid Passeres in the Old World, of which the Pittidæ can hardly be said to have only a "very restricted distribution."

The Australian genus Struthidea, of doubtful position, seems omitted altogether.

W. A. FORBES
Cambridge, Oct. 30

Antedon Rosaceus (Comatula rosacea)

THERE are one or two rather hasty conclusions in the letters you have recently published upon the feather-star, which I will take the liberty of pointing out. My friend, Major Lang, arguing from his experience in Torbay, says: "It is evident that the habitat of Comatula is strictly defined, viz., in comparatively deep water, and amongst rocks." Last year, however, I took it in Salcombe Estuary, in shallow water, and not among rocks, but among the *Zostera marina*, to which numbers of the young stalked form were sticking. The well-known marine zoologist, Mr. Hincks, tells me that he took both the adult and stalked forms in great abundance in the same locality more than twenty years ago.

The President of the Birmingham Natural History and Microscopical Society, in commenting upon Major Lang's letter and other notices of the capture of the feather-star, says, "It is a most remarkable circumstance, therefore, that in the space of about three years, the species should have become numerous to the extent alluded to by Major Lang, more than a hundred being taken in one haul of the dredge." But this rapid increase in the numbers of the species since 1873 is imaginary, for dredgings in the two previous years had yielded the adult form by bucketsful from the neighbourhood of the Thatcher Rock.

In regard to the name, one can only wish for a scientific dictator to restore Lamarck's happily appropriate designation *Comatula*, in place of the earlier name, Antedon, the meaning and pronunciation of which are alike difficult to determine. It would be interesting to learn from political economists, in what category of labour, productive or unproductive, those investigations should be reckoned, which end in displacing some name universally received and understood in favour of one forgotten and obsolete. Justice to the ancient observer is pleaded as a chief reason for these revivals. But it is a poor renown to have helped to increase the ever-growing burden of scientific nomenclature.

Torquay, Nov. 6 THOMAS R. R. STEBBING

If you can afford the space I shall be glad to add a few words to the recent communications of Major Lang and Mr. Hughes to NATURE on the occurrence of *Antedon rosaceus* in Torbay.

I do not think *Antedon* has been more abundant than usual during the present year in this locality. An entry in an old note-book reminds me that a chance haul near the Thatcher Rock on July 11, 1871, brought up "plenty of feather stars," and since then during the six years I have dredged in Torbay, *Antedon* has been a very ordinary capture whilst dredging for other objects of interest.

The haul under Berry Head on July 25, alluded to by Major Lang, was undoubtedly an unusually prolific one, but had it not been for the fortunate discovery by Major Lang of the pedunculate form, the mere occurrence of an abundance of the adult feather stars would have made no impression on my mind and no notice would have been taken of it.

Remembering that the Birmingham Natural History Society had taken the young, I mentioned the fact to Major Lang, adding that I had never seen them myself. Next morning I was gratified to hear that on examining at his leisure the proceeds of the haul he had found them in quantity.

This successful result induced me to revisit the spot near the Thatcher after an interval of six years, and there, as I fully expected, *Antedon*, both adult and immature, was abundant. With this experience to guide me, I have since tried a third locality, when, though the adults were less numerous, the pedunculate young, and every stage of growth up to about an inch in diameter, appeared to me to be even more numerous than at Berry Head or the Thatcher.

In conclusion, I beg to say that it will give me pleasure to afford the fullest information in my power to any naturalist desirous of dredging in Torbay. It has often been a source of regret to me to see strangers wasting their time in dredging in spots where, as my old boatman used to say, they could not expect to meet with anything "of any consequence."

ARTHUR ROOPE HUNT

Southwood, Torquay, November 6

As the localities of *Antedon rosaceus* seem to be exciting interest, I may notice that I dredged the adult state in June, 1875, in Bressay Sound, sheltered in about 10 fathoms water, and in June, 1876, abundantly between Mount St. Edgecumbe and Duke Island, Plymouth, in about the same depth of water, in each case on a rocky bottom.

PHILIP B. MASON

Burton-on-Trent, November 8

Meteor

On November 6 I observed a large meteor of a red colour. It commenced near the zenith and took a sinuous course about west-south-west, dividing into two portions after it had travelled about 40°, one portion disappearing about 10° above the horizon nearly due west, the other taking a north-west direction, and disappearing somewhat higher; it was not very bright, but seemed to be a large one. I should like to hear if anyone else has seen it; the time was between 8 and 9 P.M.

Clithero, Lancashire

T. NOSTRO

THE MUSICAL ASSOCIATION[1]

THE third annual session of this Society opened on Monday, November 6, with a paper of considerable interest from Alexander J. Ellis, Esq., F.R.S., "On the Sensitiveness of the Human Ear for Pitch and Change of Pitch of Notes in Music."

It appears from the Annual Report, just issued, that the Association numbers 170 members, and is in a sound financial position. It may therefore be considered to have passed its period of infancy, and should now be permanently reckoned among the learned confederations of the metropolis.

It is not altogether uninteresting to look back at its origin and to point out the fulfilment of the especial objects for which it was established.

The first conception appears to have emanated from Mr. William Spottiswoode, Dr. Stainer, and a few other gentlemen, representing about equally the scientific and artistic sides of music, who circulated a letter among their friends, and in a private meeting held at the house of the Treasurer of the Royal Society, laid the foundations of its future organisation. The original title chosen for the new society explained at more length its peculiar objects than that which it now bears; it was "Society for the Investigation and Discussion of Subjects connected with the Art and Science of Music."

The double function herein indicated has hitherto been steadily and rigorously carried out. Indeed the Council for 1876-7, numbering among its members eminent musicians such as the two professors of Oxford and Cambridge, Messrs. Hullah, Osborne, Goldschmidt, and Dr. Stainer, is supplemented on the side of Science and Literature by the familiar names of Mr. Spottiswoode, Prof. Tyndall, Dr. Pole, Mr. W. Chappell, and Mr. George Grove.

The contributions recorded in the two annual volumes of "Proceedings" are strictly in concordance with the initial programme; they cannot be better summed up than in the words of Mr. Spottiswoode's letter above-named, advocating "the formation of a society similar in the main features of its organisation to existing learned societies. Its periodical meetings might be devoted partly to the reading of papers upon the history, the principles, and the criticism of music, partly to the illustration of such papers by actual performance, and partly to the exhibition and discussion of experiments relating to theory and construction of musical instruments, or to the principles and combination of musical sounds."

In the first year Mr. Hullah, Dr. Stainer, and Mr. Sedley Taylor, spoke on musical notation and nomenclature; Mr. Bosanquet and Mr. Ellis furnished valuable illustrations of true and tempered intonation; Mr. Charles E. Stephens criticised Dr. Day's theory of harmony; Mr. Baillie Hamilton and the writer described their respective improvements in musical instruments.

During the second session there were two papers of great value, mainly historical, from Sir F. Ouseley, "On the History of Ecclesiastical Music in Western Europe;" and from Prof. W. G. Adams "On Wheatstone's Musical Inventions," two "On Notation," by Dr. Pole and Prof. Monk; two mathematical and physiological, by Lord Rayleigh, "On Our Perception of the Direction of a Source of Sound," and Mr. Lennox Browne "On the Management of the Voice;" two mechanical and instrumental, by Mr. de Pontigny, "On Kettledrums," and by the writer "On Standards of Musical Pitch;" one critical, perhaps even polemical, by the active secretary of the Association, Mr. C. K. Salaman, "On Musical Criticism."

Several of the above communications, especially Mr. Bosanquet's two exhaustive papers "On Temperament," call for full analysis; but the general status and purpose of the Association itself are so far novel as to deserve preliminary attention. Music, of all æsthetical subjects, is that which is most deeply marked by its bisection into art and science; much of the art, little of the science is ancient; for Euclid, Pythagoras, and even Galileo carry us only a short distance into the laws of harmony. But it is peculiar to music that instruments accidentally invented, slowly improved, fabricated simply for performance, and intended solely to charm the ear, have at a later period furnished the tools and apparatus of scientific analysis. The violins of Gaspar di Salo and Straduiarius, have for centuries illustrated the laws of harmonic sounds, and even as early as the time of Tartini, furnished the *Terzo Suono*, which figures so boldly in modern acoustics.

As the instruments themselves fulfil a double purpose, so are their votaries divided into two very distinct classes, those namely of artists and theorists. The essential value of Mr. Spottiswoode's proposal lay in the appreciation of this schism, and of the means towards healing it. The

[1] Report and Proceedings of the Musical Association for 1874-5 and 1875-6.

artistic world of music, great as the individual acquirements of some members as executants may be, is essentially a world of handicraftsmen; practising indeed a very subtle art, but led entirely, according to Aristotle's definition, by rules, and not by laws.

The function of the scientific man is to expand these technical rules of art into the conscious and explained laws of science. How nobly this duty has been performed by Chladni, by Savart, by Wheatstone, and above all by Helmholtz, few artists are aware; nor indeed has there been hitherto any easy mode for their obtaining such information. They have been somewhat in the habit of sneering at the theorist as a "mathematician;" nor is it very remarkable that the other party, like the Dublin fishwife whom O'Connell called a parallelopipedon, should retaliate with even more opprobrious epithets. Hence old threadbare jokes about "catgut-scraping," Lord Chesterfield's contempt of musicians, and the like, which culminate in the epigram on Handel and Buononcini. This century is beginning to recognise that varying styles of musical art are not a mere question of "Tweedledum and Tweedledee," and that the "fiddler," though in an utilitarian point of view unnecessary to the maintenance of life, is highly conducive to education and civilisation. If artists are to maintain the improved position of later years it must be by cordially fraternising with the man of science, for thus only can their art hope to acquire the dignity and generalisation which are the prerogatives of *ἐπιστήμη*.

It is to be noticed that this view of the case appears to have been taken by many of our best professional musicians; for the list of members which heads either volume of these "Proceedings" is far more remarkable for individual eminence of the names than for their multitude. It is to be hoped that such a conviction will continue to extend. The number of points in which music is conterminous with pure science is considerable, and is daily increasing. Music, moreover, is among the most powerful means we have for cultivating that delicacy of the senses on which all accurate observation depends. It has, as yet, been too apt to fall into the hands of a sect or clique, whose disposition is naturally exclusive, and whose objects have often been the reverse of elevated. But with the great advance which has of late years taken place in general musical knowledge throughout England, and by the fostering care of societies like the present there is ground for anticipation that the science of music may rise to the esteem and consideration as an educator and humaniser which it once held in the writings of Plato, and in the palmiest days of old Greek thought.

W. H. STONE

ON THE RESISTANCE OF THE AIR TO THE MOTION OF PROJECTILES

THE experiments made by Hutton to determine the resistance of the air to the motion of shot were carried out by firing small spherical balls into the receiver of a gun-pendulum. As little confidence could be felt in applying his results to the large service shot at present in use, on the formation of the Advanced Class of Royal Artillery Officers, Woolwich, in 1864, it was thought desirable that a systematic course of experiments should be made with *elongated* shot, and upon a much larger scale. Afterwards, similar experiments were made with *round* shot.

The method of experimenting pursued by Hutton appeared to have been carried to its useful limits, and although a large ballistic pendulum had been constructed for Government, it was practically useless. The chronograph used in the experiments above referred to was invented and constructed for that purpose by the Rev. F. Bashforth, at that time Professor of Applied Mathematics to the Advanced Class, and Official Referee to the Ordnance Select Committee. This instrument is now in the Loan Exhibition, South Kensington.

A complete collection of the "Reports on Experiments made with the Bashforth chronograph, 1865-1870" (marked 84, B, 1941), has been published by Government, at the nominal price of one shilling.[1] It will therefore be sufficient here to state that the first set of experiments was made to test the new chronograph, in which the velocity of the shot varied from about 1,150 f.s. to 1,060 f.s. The resistance of the air was found to vary as the *cube* of the velocity. The next experiments were made with *elongated* shot of equal diameters and different forms of head. The velocities here varied from 1,500 f.s. to 1,090 f.s., and the law of resistance still appeared to be the *cubic*. Lastly, a course of experiments was made with *elongated* and *spherical* projectiles (solid and hollow) of 3, 5, 7, and 9 inches in diameter. The velocities of the elongated shot varied from 800 f.s. to 1,750 f.s., and those of the spherical from 800 f.s. to 2,400 f.s. At a given velocity the resistance of the air varied as the square of the diameter. But when the coefficient of resistance was obtained by dividing the numbers expressing the resistances by the cube of the corresponding velocity, the result was not now constant through these great variations of velocity. This coefficient was found to increase rapidly from 900 f.s. up to 1,050 f.s., and from 1,100 f.s. to 1,300 f.s. it was nearly constant, and for higher velocities it gradually decreased with the increase of velocity. The published reports give a full account of every round fired. Unfortunately it has not hitherto been found possible to express the coefficient of resistance by a simple function of the velocity. Mr. Bashforth has made use of the cubic law in his treatise on the motion of projectiles (1873). The trajectory is divided into arcs, and each arc is supposed to be described, while the coefficient of resistance retains its mean value for that arc.

In a tract on the remaining velocities, &c., of several service shot (1871),[2] Mr. Bashforth stated:—"For ogival-headed elongated shot, the resistance of the air may be said to vary roughly as the *sixth* power of the velocity for velocities 900-1,100 f.s.; to vary as the *third* power for velocities, 1,100-1,350 f.s.; and to vary as the *second* power for velocities above 1,350 f.s."

General Mayevski, Professor of Ballistics to the Academy of Artillery, St. Petersburg, published a work on Ballistics in Russian, in 1870, at the expense of the State. A translation of the more interesting chapters of this work was published in French by the author, in 1872.[3] In the preface to the latter work he states that "Les résultats des expériences faites par M. Bashforth en Angleterre sur les projectiles oblongs ont été déduits des données insérées dans les *Proceedings of the Royal Artillery Institution, Woolwich*, 1868. Les expériences de St. Pétersbourg sur la résistance de l'air au mouvement des projectiles sphériques et oblongs ont été faites par nous en 1868 et 1869, et leurs resultats sont pour la première fois publiés dans notre traité. Afin que les expressions de la résistance représentent, avec une approximation suffisante, les résultats de nos expériences et ceux des expériences anglaises, faites avec des appareils perfectionnés, et que ces expressions permettent en même temps une intégration facile, *quoique par approximation*, des équations différentielles du mouvement, nous avons admis *pour les projectiles sphériques*, dans les limites des vitesses de 530^{ms} à 376^{ms} (1739-1230 f.s.) la résistance de l'air proportionelle au carré de la vitesse, et nous avons exprimé, à partir de la vitesse de 376^{ms} (1230 f.s.) jusqu'aux petites vitesses, la résistance de l'air par un binome dont le premier terme est proportionel à la deuxième puissance de la vitesse, et le second à la quatrième puissance de la vitesse; *pour les projectiles oblongs*, quand leur axe de figure coïncide avec la direction du mouvement, nous

[1] W. Clowes and Son; Allen; Mitchell; Longmans and Co.
[2] London: Spon. [3] Paris: Gauthier-Villars.

avons admis, dans les limites des vitesses de 510^{ms} à 360^{ms} (1673-1180 f.s.) la résistance de l'air proportionelle au *carré* de la vitesse; dans les limites des vitesses de 360^{ms} à 280^{ms} (1180-920 f.s.) nous l'avons admise proportionelle à la *sixième* puissance de la vitesse, et nous avons exprimé, à partir de la vitesse de 280^{ms} (920 f.s.) jusqu'aux petites vitesses, la résistance de l'air par un binome dont le premier terme est proportionel à la deuxième puissance de la vitesse et le second à la quatrième puissance de la vitesse," &c. (pp. vi., vii.). So that Mr. Bashforth employs one single law, the *cubic*, and makes his coefficient vary to suit the velocity, while General Mayevski varies his law of resistance according to the velocity. But in neither case does the law of resistance admit of direct integration. Mr. Bashforth supplies this defect by extensive tables calculated by quadratures, and granting the cubic law, the results are exact. General Mayevski's integrations are approximations, and require extensive tables also. But there is no dispute as to the amount of resistance encountered by elongated shot in moving through the air. For General Mayevski observes: "Aussi pour compléter les données se rapportant aux projectiles de forts calibres, nous avons profité des tableaux des vitesses décroissantes déduites par M. Bashforth de ses expériences faites en 1868 au moyen de son chronographe; ces tableaux comprennent les vitesses de 518^{ms} à 283^{ms} (1700-930 f.s.), qui correspondent aux trajets de 305 en 305 mètres des projectiles oblongs de 178^{mm}, 203^{mm}, et 229^{mm} (7, 8, and 9 inches), et qui sont obtenues pour le cas où le mouvement des projectiles peut être considéré comme rectiligne. Nous avons calculé d'après les résultats insérés dans ces tableaux les valeurs de la résistance correspondantes à différentes vitesses" (p. 38).

Projectiles Oblongs.

Bouches à feu.	Vitesses *v*.	Valeurs de ρ'.	Bouches à feu.	Vitesses *v*.	Valeurs de ρ'.
	ms.			ms.	
C. de 4^{l}	172	0·0151	C. de 203^{mm} ...	329	0·0338
C. 203^{mm}	207	0·0137	C. de 203^{mm} angl.	332	0·0327
C. de 4^{l}	239	0·0148	C. de 229^{mm} angl.	334	0·0332
C. de 12^{l}	247	0·0170	C. de 4^{l}	337	0·0341
C. de 24^{l}	266	0·0160	C. de 178^{mm} angl.	340	0·0334
C. de 203^{mm} ...	282	0·0163	C. de 203^{mm} angl.	345	0·0354
C. de 203^{mm} angl.	287	0·0184	C. de 229^{mm} angl.	355	0·0364
C. de 229^{mm} angl	291	0·0247	C. de 178^{mm} angl.	358	0·0382
C. de 203^{mm} angl.	300	0·0230	C. de 203^{mm} ...	360	0·0384
C. de 178^{mm} angl	302	0·0218	C. de 203^{mm} angl.	360	0·0393
C. de 12^{l}	304	0·0221	C. de 4^{l}	401	0·0450
C. de 4^{l}	307	0·0158	C. de 203^{mm} ...	409	0·0430
C. de 229^{mm} angl	316	0·0305	C. de 203^{mm} angl	419	0·0433
C. de 4^{l}	317	0·0259	C. de 229^{mm} angl.	420	0·0427
C. de 203^{mm} ...	319	0·0174	C. de 203^{mm} angl.	460	0·0449
C. de 203^{mm} angl.	320	0·0277	C. de 203^{mm} angl.	508	0·0440
C. de 24^{l}	320	0·0299	C. de 178^{mm} angl.	512	0·0443
C. de 178^{mm} angl.	322	0·0270			

It ought to be stated that Hutton's results for spherical shot are very good indeed for velocities above 1200 f.s., while Didion's results, intended to correct Hutton's, were not quite so good. They both failed for lower velocities. It would be interesting to have the resistance of the air to projectiles determined for velocities below 900 f.s. But very considerable difficulties would be met with if the experiments were conducted in the usual manner, for the chronograph is most effective when there is a rapid variation of velocity. In the middle of the range the screens would have to be raised to a considerable height. It would be found difficult to fire shots through them all. If the shot were fired at low initial velocities from the ordinary rifled gun, there might be considerable doubts respecting the steadiness of the shot.

Reference must be made to the collection of scientific memoirs on ballistics by the Comte de St. Robert published in 1872,[1] although they do not supply any new experimental data.

[1] Turin: Vincent Bora.

As it is found impossible to integrate the equations of motion of shot for the simple laws of resistance, of square cube, &c., it appears almost hopeless to search for an expression of the complicated law now known to hold good through a considerable range of velocities. These results would serve as tests of any theory of the resistance of the air; and if any theoretical investigations did satisfy these conditions, then we should have an expression for the resistance of the air to the shot, but it is almost certain that it would be too complicated to be of practical use. B.

A LOCAL MUSEUM

THE population of the parish of Morton, 1871, was 2,099—the chief village, Thornhill, containing about one half of the population of the parish. The parish is situated on both banks of the Nith in the North of Dumfriesshire, Scotland. Yet sparse as is the population, and remote from the great commercial centres as is the district, it is supplied with a museum which well might grace a place of far more wealth and consequence. The building was erected by Thomas B. Grierson, and the collections in the museum were formed by him. The Duke of Buccleuch granted the land on which to build, together with stone. The memorial stone was laid with masonic honours in June 1869. The building, which was from the design of a local architect, is an oblong, consisting of a ground floor and gallery. The gallery is very appropriately supported by six oaks, as brought from the forest, being among the last of the natural woods of Nithsdale.

The *débris* excavated for the foundation has been well utilised by forming a large mound in the surrounding garden, which is faced on all sides by an excellent collection of the minerals and curious stones of the district, and forms a suitable habitat for hardy plants. The garden contains a great variety of flowering plants, of shrubs, trees, and cryptogamous vegetation, and is laid out with considerable art. Large objects, which do not suffer waste by atmospheric causes, such as stone crosses and querns, are placed at intervals in the walks. Great prominence has been given in the collections inside the building to objects which illustrate the history of the country. These include some valuable relics belonging to the Covenanters of the seventeenth century, and to the poet Burns. The collections illustrative of the unpolished and polished stone-period are very valuable. Some beautifully wrought cells and stone-hammers have been yielded by this part of Nithsdale. The bronze and iron collections are very fair. Among the quadrupeds is a skull of the ancient ox which roamed wild less than a century ago in Drumlanrig Parks, and which belong to the same variety as those at Chillingham and Hamilton Palace, which are supposed to be the sole survivors of the ancient Caledonian Urus. Among fish there is an interesting collection, which was the gift of the late Mr. Shaw, illustrative of the natural history of the salmon, and which shows that animal in its various different stages. The late Mr. Shaw threw great light on the development of the salmon, and destroyed some popular delusions concerning it. He was a keeper in the district under the Duke of Buccleuch. The abnormal form of animals are very various, many opportunities having occurred to fill the cases devoted to these from the pastoral and agricultural district around. In the collection of fossils due prominence is given to those belonging to the strata of the south of Scotland, and the industrial departments contain specimens of the manufactures of the country. The museum is free to the public on Saturday, and open for a small sum during the week. School children are admitted along with their teachers gratuitously on application. The proprietor, Dr. Grierson, is most indefatigable in his attentions and explanations to all willing to learn from his collection of objects. The

number of persons who have been admitted for the first time since the museum was opened, July 1872, is about 4,000. There is a society in connection with the museum which meets monthly, having for its object original research. Papers have been contributed, amongst others, by Dr. Grierson, Dr. Sharp of the London Entomological Society, and Mr. Shaw, schoolmaster. Dr. Sharp gave an exhaustive account of the Colorado beetle, and Mr. Shaw illustrated, by means of large diagrams, Darwin, Lubbock, and Müller's discoveries on the fertilisation of flowers by insects.

J. SHAW

Tynron, Thornhill

THE AUSTRIAN ARCTIC EXPEDITION[1]

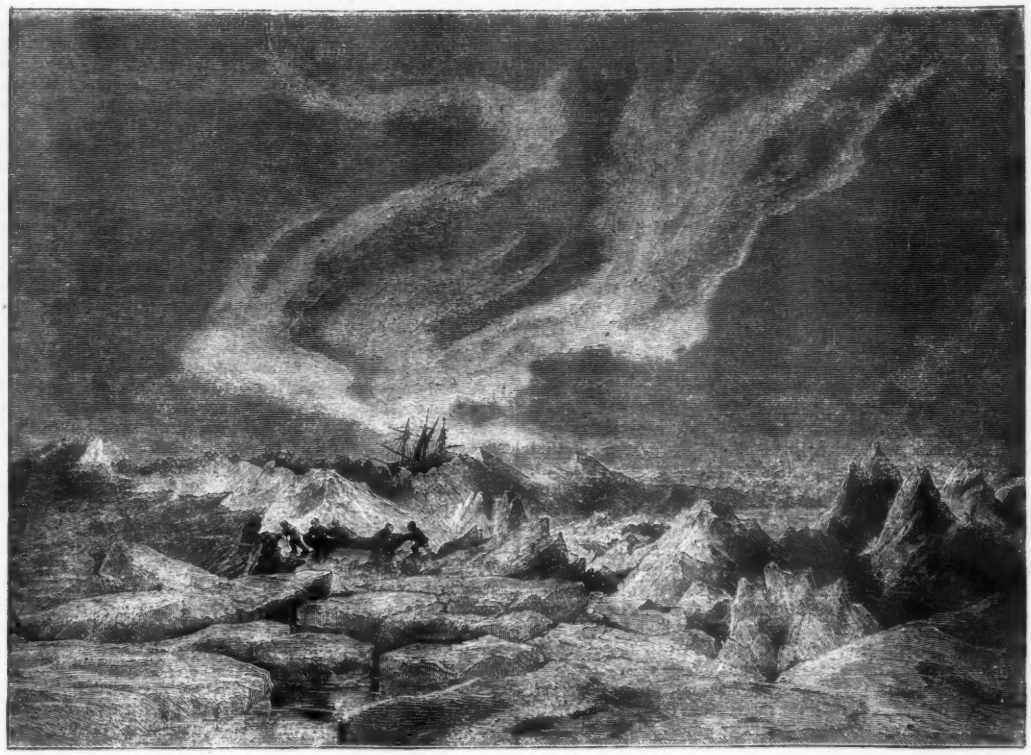
NO doubt most of our readers have some acquaintance with the story of the memorable Austro-Hungarian Arctic Expedition in the *Tegetthoff* under the leadership of Lieutenants Payer and Weyprecht. We have at various times since the return of the expedition, upwards of two years ago, given details of the adventures of the party and of the results obtained; in vol. x. p. 524, we published a map showing the geographical discoveries which had been made. In the work named below all who have heard anything of the expedition or who take an interest in Arctic exploration will be glad to have a complete history of its doings from the artistic and graphic pen of one of its commanders, Lieut. Payer. We venture to think that Payer's narrative is likely to take its place among the classics of Arctic exploration; the skill with which he has told the story of an expedition so full of strange and unexpected events, the enthusiasm and interest which mark every page, its pathos and humour, the value of the information it contains, and the attraction of its numerous illustrations, are sure to make it a permanent favourite with old and young, and constitute it an authority on Arctic matters generally.

The Austrian Flag Planted at Cape Fligely.

The *Tegetthoff*, a screw steamer, expressly built for the purpose of this expedition, of 220 tons burden, fitted out for two years and a half, left Bremerhaven June 13, 1872, and Tromsoe about a month later, [for the purpose of exploring the Arctic Seas in the Novaya Zemlya region. The vessel was equipped mainly at the expense of the Austrian Count Wilczek, and, including officers and men, had only twenty-four souls on board. The ultimate destination of the expedition was not rigidly defined; they might make their exit by Behring Straits, or winter on the Siberian coast, or on any lands which they might be fortunate enough to discover. The first ice was met with in about 74° N., near the coast of Spitzbergen, and it remained with the ship more or less till the end. Only the year before, in a preliminary reconnaissance in a small sailing vessel, the *Isbjörn*, by Count Wilczek, the sea between Spitzbergen and Novaya Zemlya was found to be almost free of ice, and with a properly-equipped steam-vessel there seemed to be no obstacle to pushing northwards indefinitely. In 1872 things wore a very different aspect. The ice was entered in 74° N., and it required careful navigation to reach Cape Nassau, near which the *Tegetthoff* was overtaken by Count Wilczek in the

[1] "New Lands within the Arctic Circle. Narrative of the Discoveries of the Austrian Ship *Tegetthoff* in the Years 1872-1874." By Julius Payer, one of the Commanders of the Expedition. Maps and numerous Illustrations. Two vols. (London: Macmillan and Co., 1876.)

Isbjörn, who had thoughtfully followed to establish a depot for the exploring ship in the north of Novaya Zemlya. The two ships parted company on August 20, and a few hours after the *Tegetthoff* was beset by the ice in lat. 76° 22′ N., long. 63° 3′ E., and she never afterwards got out. Completely at the mercy of the moving ice-field, the ship drifted slowly in a general north-east direction during the winter, till somewhat north of 79° she turned westward in the middle of February, 1873. Though generally westward, the course was somewhat erratic. During the spring and summer of 1873, every effort was of course made to free the ship from her helpless position, in which apparently nothing could be done to carry out the object of the expedition. To be imprisoned thus for another winter appeared utterly intolerable, but all the efforts made failed, and by August everyone felt resigned to the inevitable. In August the ship took a turn towards the north, and on the 30th of that month the whole aspect of things suddenly brightened for the ice-bound explorers by the unmistakable sight of new lands. When in 79° 43′ N. and 59° 33′ E., new life was awakened in every breast by the sight of the mountains and glaciers of what is now known as Kaiser Franz-Josef's Land. Thus, then, when hope was lowest, the expedition drifted into success. It was too late that season to explore the new-found land, and it can easily be imagined how impatient all were for the advent of spring, to enable them to commence to gather the fruits of their lucky find. Lieut. Payer strongly advocates autumn as the best season for sledging, but as they could not run the risk of another winter in the ice, the sledge journeys were commenced early in March, and by the beginning of May Lieut. Payer had made



The Aurora during the Ice Pressure.

three separate expeditions into Franz-Josef Land. In the first expedition, a short one, he explored Wilczek Island, the most southerly, and the south part of Hall Island. In the second journey he went right northwards, 160 miles, as far as he could go with sledges, to Cape Fligely, 82° 5′, making several subsidiary trips right and left of Austria Sound, on which he travelled, and which separates the two main divisions of Franz-Josef Land into Wilczek Land and Zichy Land. Finally a third short expedition was made to the north-west to M'Clintock Island, and on May 20, 1874, all necessary preparations having been made, the good ship *Tegetthoff* was abandoned. No other course was open to the commanders, if they did not want to run the risk of perishing along with their greatly enfeebled crew. By sledging and boating, a painful, wearisome, and slow progress southwards was made, so slow that in two months they were only nine miles from the ship, with a rapidly diminishing stock of provisions, though tobacco and water seem to have been the greatest wants; Payer says you could not have then done a man a greater favour than ask him to a pipe and a glass of water. Fortunately the open water was met with in about 78° N., and with little difficulty the wearied party rowed and sailed southwards along the west coast of Novaya Zemlya, until finally rescued, on August 24, by a Russian fishing-vessel at Cape Britwin. On September 3, all except poor Krisch, the engineer, who died of consumption and was buried on Wilczek Island, reached Vardö, not much the worse of their extraordinary experiences.

This bald outline of the course of the expedition can give one no idea of the intense interest which the detailed narrative assumes in the pages of Lieut. Payer. With the hand of a true artist, with pen and pencil, he sketches

the life of the apparently forlorn party from day to day, with such clearness, and force, and sympathy that the reader becomes familiar with the peculiarities of each individual, and feels towards him in the end like an old acquaintance. The ways and characteristics of the very dogs, Jubinal and Sumbu and Pekel, and the rest, are sketched in a manner that would delight the heart of the author of "Rab and his Friends." While the work only pretends to be a general account of the expedition, it contains much of scientific value. Most of the scientific results yet remain to be published, though from time to time papers by Weyprecht, Höfer, and others appear in Petermann's *Mittheilungen*, containing elaborate discussions of the various scientific observations; we published some account also of the scientific results in three articles in NATURE, vol. xi. p. 366, *et seq.* Of Franz-Josef Land itself the author, by drawings, descriptions, and map, conveys a satisfactory idea. It is evidently an archipelago of about the size of Spitzbergen, stretching from about 80° to at least 83° N. lat., but how far from east to west is not ascertained. Running north and south, on each side of Austria Sound, are two main stretches of land, Wilczek and Zichy Lands, broken up, the latter especially, by many deep fiords, and with many islands in the channel between them. Payer got as far north as Cape Fligely, in 82° 5′ N., and from that saw land stretching northwards to 83°, Petermann Land, and another coast-line far to the west, King Oscar Land. The land, as might be expected, is a barren one, with mountains 2,000 to 5,000 feet high, and glaciers of such size, as argues that the country must have very considerable breadth. In many parts, and as far north as Payer went, animal life, bears and seals, and thousands of Arctic birds in great variety, abound; during the whole time of the expedition's sojourn fresh meat of some kind was seldom lacking. At Cape Fligely open water was met with, but it was only an extensive ice-hole or "polynia;" the idea of an "open Polar Sea" Lieut. Payer does not for one moment entertain. Distinct recent traces of foxes and even of hares were seen in some places, but no actual specimens were met with. Under the summer-sun, Lieut. Payer is of opinion, numerous streams will rush down the mountain sides, and some of the valleys be clothed with verdure. But for most of the year there is nothing but barrenness and ice and snow; the land is, of course, uninhabitable, and no trace of human beings was discovered. The islands are evidently volcanic, and reminded Lieut. Payer geologically of the rocks of North-east Greenland. Brown coal was found and coarse-grained dolerite abounds. But for details as to the appearance, the geology, the fauna, and flora, and other characteristics of Franz-Josef Land, we must refer the reader to the work itself. It would certainly be interesting to know more of this discovery, and perhaps means may yet be found to gratify a justifiable curiosity. The discovery of this group of islands greatly favours the theory of those who maintain that the Arctic basin is mainly an archipelago, and after all, our own expedition has found nothing that seriously weakens the theory.

From a scientific point of view the first chapter is probably one of the most important in the work. Lieut. Payer has evidently made a thorough study of ice in all its phases, both by means of direct observation (and both in the Novaya Zemlya seas and on East Greenland he has had ample opportunities for this) and by extensive reading of the works of previous explorers. In this first chapter are given the results of this investigation, the characteristics of ice of all kinds—field-ice, pack-ice, hummocks, icebergs, and other forms—in a more systematic and thorough manner than we remember to have seen before. Many popular delusions he demolishes, and writes with an accuracy and fulness that must be satisfactory to those who have had no opportunity of studying ice-forms for themselves. Icebergs, he tells us, with long, sharp-pointed peaks, like those exhibited in numerous illustrations, have no real existence. It is only fragments of field-ice, raised up by pressure, exposed to the action of waves and the process of evaporation, which are transformed into fantastic shapes. Icebergs are of a pyramidal or tabular shape, and in time they are usually rounded off into irregular cones. Altogether this chapter on ice is exceedingly instructive. The masses or thickness of floe-ice depends, he shows, not on age alone, but on several influences, pressure being one; so that the enormously thick ice met with by our own expedition does not need to be regarded as a remnant of the last glacial epoch, but due probably to unusual pressure, and the heaping of one mass upon another.

The year 1871, we have said, was in the Spitzbergen seas a great contrast to 1872, while 1874 again was as open as 1871. One of the most interesting, and in some ways instructive passages in the work, is where Lieut. Payer describes the fearful pressure to which the ship was subjected as she drifted northwards. For months these poor men had nightly to rush from their bunks on to deck ready to abandon the ship, which they expected to see every moment crushed to splinters. Payer's descriptions of the appearance and the agonising noises accompanying the ice-pressure are most impressive. The ice was comparatively smooth when first the ship entered it, but shortly the party were startled, when forced to rush on deck by the dreadful sounds which awakened them, by seeing the whole field crushed together, broken up, the pieces piled on the top of each other and lying at all sorts of angles, not unlike, indeed, the description given by Capt. Nares of the "Palæocrystic ice." Is not this, possibly, one more proof that the sea to the north of Robeson Channel was in an exceptional condition last spring? That we are almost entirely ignorant of the laws that regulate the movements of the ice in these regions is evident; no two successive years are alike, and the condition of one part cannot be inferred from that of another. In that very June, 1872, when the *Tegetthoff* was beset so far south on the Novaya Zemyla side, the *Polaris* pushed north with ease to 82° 16′ by the Smith Sound route, and could have gone further; and this year, when our own ships have had a life-and-death struggle with palæocrystic ice, whalers have been cruising and making easy discoveries between 81° and 82° N., on the Spitzbergen side. If any satisfactory results are to be obtained concerning these Arctic regions, is it not evident that the only means to obtain them is by the establishment of permanent stations all round? This is the conclusion to which Lieut. Weyprecht, one of the commanders of this expedition, has been driven. By the by, we would recommend Payer's description of the results of ice-pressure to geologists who desire to have a forcible illustration of the results of pressure in changing the configuration of a surface.

In these introductory chapters the author gives many valuable directions as to the equipment and conduct of Arctic expeditions, and, it may not be amiss to state, expresses his complete approval of M'Clintock's method of constructing and fitting sledges. We recently referred to the suggestion of the use that might be made of ballooning in Arctic exploration; Lieut. Payer thinks that valuable results might be obtained by means of a captive balloon. As to the Gulf Stream, he gives little ground for believing that it extends much beyond Spitzbergen; indeed he thinks that the wind was the main cause of the drift of the ship; though Baron von Wüllersdorf, who has discussed some of the results of the expedition, thinks it probable that there exists a sea-current in the seas between Novaya Zemlya and Franz-Josef Land; that at any rate its existence cannot positively be denied, although the prevailing winds may produce similar phenomena. He also thinks there is a great probability that the ocean stretches far to the north and east beyond the eastern end of Novaya Zemlya.

The crew of this expedition was a mixed one—German,

Sclavonic, Italian, Norwegian, and English being spoken, though all orders were given in Italian. It was well selected, and the ships equipped according to the most approved directions, but still scurvy broke out, though apparently not to so serious an extent as in the case of the *Alert* and *Discovery*. Fresh meat was abundant, and everything known to prevent or counteract the disease, but it broke out in both winters, the men improving during spring. Payer is distinctly of opinion that a judicious use of alcohol is a preventive, but evidently the real cause of this scourge of Arctic explorers has yet to be found out. The lowest temperature met with was a little over 40° R., though the general temperature was much milder. No one suffered seriously from frost bites, though they were common. The single death was due to consumption.

The conduct of the expedition by its two leaders, and the behaviour of officers and men, were all that could be wished. Observations in meteorology and magnetism, on the Aurora (of which there were many magnificent displays), geology, biology, and other departments of science were regularly and carefully made, and will no doubt gradually find their way into the general body of scientific knowledge and deductions. Unfortunately, many of the specimens, geological and zoological, had to be left behind with the ship. On the whole, this expedition is one of the most satisfactory in its conduct and results of all that have gone out to gather knowledge in these inhospitable regions, and Lieut. Payer has written its story in a style not surpassed in fascinating interest and scientific value by any of those old narratives that are still the delight of all who love to read of the adventures of daring men. The translator has had a hard task before him in putting the narrative into English dress, but he has succeeded, we think, completely; while retaining an unmistakable German flavour, the English version is thoroughly idiomatic and readable.

OUR ASTRONOMICAL COLUMN

THE NINEVEH SOLAR ECLIPSE OF B.C. 763.—In the Rev. A. H. Sayce's notice of the discoveries of the late Mr. George Smith amongst the Assyrian inscriptions in the British Museum (NATURE, vol. xiv. p. 421), reference is made to a solar eclipse in the month Sivan, which has been fixed to the year B.C. 763, June 15 (not in *May*, as printed in the notice quoted). The following are elements of this important eclipse—which has so direct a bearing upon the Assyrian chronology of the period—deduced upon the same system of calculation adopted for other ancient eclipses previously alluded to in this column:—

Greenwich Mean Time of Conjunction in R.A., B.C. 763, June 14, at 19h. 9m. 25s.

R.A.					73	9 43
Moon's hourly motion in R.A.						39 56
Sun's ,, ,, ...						2 34
Moon's declination					23	10 10 N.
Sun's ,, ...					22	53 4 N.
Moon's hourly motion in decl.						0 54 N.
Sun's ,, ,, ...						0 17 N.
Moon's horizontal parallax						60 9
Sun's ,, ,, ...						0 9
Moon's true semi-diameter						16 24
Sun's ,, ,, ...						15 25

The sidereal time at Greenwich noon was 4h. 57m. 47s., and the equation of time 8m. 4s. additive to mean time. Hence the middle of the eclipse fell at 19h. 8m. 52s., and the following would be points in the line of central and total phase:—

Longitude ...	35	14 E.	Latitude ...	30	59 N.
,, ...	40	2	,, ...	32	58
,, ...	43	35 E.	,, ...	34	19 N.

Sir George Airy places the Pyramid of Nimrud in long. 43° 20′ 8″ E., and lat. 36° 6′ 1″. Calculating directly for this point from the preceding elements we find a very large partial eclipse—

Beginning June 15 at 7h. 52m. A.M., local M.T.
Ending ,, ,, 10 23 ,, ,,

Greatest phase at 9h. 8m. A.M., magnitude of eclipse 0·987.

The breadth of the zone of totality in the longitude of Nimrud measured upon the meridian was 2° 5′, whence it appears that this point is distant by calculation about 50′ outside the northern limit, but at this remote period a very small alteration in the value of the moon's secular acceleration employed would suffice to bring Nimrud within the total eclipse, and it has been inferred that the eclipse was probably *total* at the station of the Assyrian Court, from the circumstance of the inscription referring to the phenomenon being underlined in the Assyrian Canon or register of annual archons at Nineveh, although there is no interruption in the official order of the Eponymes.

The discovery of the record of this eclipse was first announced by Sir Henry Rawlinson, in May, 1867.

THE COMET OF 1652.—This comet, which was observed for about three weeks only, is stated by Hevelius and Comiers to have equalled the moon in apparent magnitude, a fact pointing to a near approach to the earth. At present we have only the elements given by Halley in his "Synopsis Astronomiæ Cometicæ," which were calculated upon the observations of Hevelius, extending from December 20, 1652, to the 8th of the following month, published in the scarce volume of his "Machina Cœlestis." From this orbit the following positions and distances result:—

12h. G.M.T.		R.A.		Decl.		Distance from the Earth.
		° ′		° ′		
1652, Dec. 12	...	124 43	...	−59 18	...	0·2275
16	...	96 19	...	43 42	...	0·1515
18	...	81 52	...	27 2	...	0·1308
20	...	69 50	...	− 6 2	...	0·1314
1653, Jan. 8	...	33 28	...	+48 50	...	0·5627

So that the comet's least distance from the earth was about 0·13 of the earth's mean distance from the sun, and the real diameter of the cometic nebulosity rather less than 110,000 miles.

THE BRIGHTNESS OF JUPITER'S SATELLITES.—In connection with a recent reference in this column to M. Prosper Henry's direct comparison of the brightness of Jupiter's satellites with that of Uranus, it may be mentioned that Dr. Engelmann of Leipsic, in his memoir "Über die Helligkeitverhältnisse der Jupiterstrabanten," taking the star 132 Tauri as 5·3 in magnitude found the respective magnitudes of the satellites

I.	m. 5·52	II.	m. 5·70	III.	m. 5·32	IV.	m. 6·28

While a reduction of light-comparisons by Prof. Auwers between November, 1858, and May, 1860, gave

I.	m. 6·43	II.	m. 6·59	III.	m. 5·87	IV.	m. 6·76

BIOLOGICAL NOTES

THE PROGRESS OF EMBRYOLOGY.—The value of Dr. Dohrn's Zoological Station at Naples has never been more conclusively demonstrated than by the publication, in a recent number (July, 1876) of the *Archiv für mikroskopische Anatomie*, of a series of researches by Dr. Bobretzky, of Kiew, on the development of certain forms of Gastropods. The systematic search for embryonic forms which is carried on under Dr. Dohrn's superintendence has enabled Dr. Bobretzky to publish a memoir of great value, illustrated by a hundred figures. His skill and success have been previously attested by his excellent researches on the development of the crustacean genera, Astacus, Palæmon, and Oniscus; and he has now passed with equal good fortune into the Gastropod group, dealing with

the genera Nassa, Natica, and Fusus. These investigations are of special interest because, according to Prof. Ray Lankester, they are the first in which the method of cutting sections has been employed in the examination of these minute eggs and embryos. To have carried the conquests of embryology to such an extent is no slight achievement. Histologists are well aware that the estimate formed of structures by viewing them as transparent objects is liable to be erroneous, even in favourable circumstances; much more so when the objects have an appreciable thickness and are more or less opaque. In all cases it is desirable to obtain, if possible, confirmatory evidence by means of sections cut through hardened specimens; but the labour and manipulative skill required are much greater than in viewing bodies as transparent objects. At the same time Dr. Bobretzky's results convey an instructive warning to those who are tempted to generalise. Nothing is more common, or more detrimental, than for a series of generalisations to be founded on a new set of observations more or less limited in their range. By the continual discovery of fresh variations in the mode in which the ova of aquatic animals are segmented, and acquire their embryonic layers, it is to be hoped that students are being led to see that nothing but summaries of observed facts are of real value at present. Dr. Bobretzky seems to have made it evident that in the genus Nassa the three primary embryonic layers are all established during the segmentation of the ovum, and as a direct result of that process; and this is certainly a surprise. Again, a definite relation has been made out in certain cases between the orifice of the earliest invagination of cells and the permanent mouth of the animal. It is to be regretted, however, that Dr. Bobretzky throws doubt on Prof. Lankester's observations on some genera of fresh-water Gastropods, in which facts of a different character were discovered. However, the latter investigator has been stimulated to examine the development of the common *Paludina vivipara* anew, and has published an account of it in the *Quarterly Journal of Microscopical Science* for October last; his previous assertions appear to be very definitely confirmed, notwithstanding that the method of sections has not been adopted: the embryos, it may be stated, are amongst the most transparent in the Gastropod class. Although it must be a disappointment to ardent theorists to find that they are so far from a satisfactory goal, it may encourage young workers when it is seen that the field for independent investigation is practically unlimited, even in embryology. In invertebrates, at least, it appears that the development of every genus should be studied, and that new facts bearing on evolution, on the distribution of life, on the influence of external conditions, on the warping, so to speak, of the direct process of development by temporary influences acting during embryonic life, will reward all diligent work in this fruitful field.

New Species of Echidna.—A very remarkable zoological discovery is announced from Genoa. Among the collections recently received by the Marquis G. Doria for the Museo Civico of that city from Mr. Bruyu, of Ternate, is a specimen of a new and large species of *Echidna* from the Arfak Mountains of New Guinea. As the only two Ornithodelphs hitherto known are exclusively confined to Australia, it is difficult to over-estimate the importance, as regards geographical zoology, of the existence of a third member of this peculiar group of mammals in the adjoining land of New Guinea.

Sphenodon Guentheri.—At a recent meeting of the Wellington Philosophical Society (New Zealand) Dr. Buller described a second species of Lizard (if Dr. Günther will allow us to call it so) of the genus *Sphenodon* (sive *Hatteria*). *Sphenodon guentheri*, as Dr. Buller proposes to designate this new form, "after the greatest of living herpetologists," is from the Brother Islands, whilst the original *S. punctatus* appear to be confined o the Karewa Island, in the Bay of Plenty.

A New Fish.—Dr. W. Peters has lately communicated to the Royal Academy of Science of Berlin the description of a new fish of the order *Leptocardii*. Of this most peculiar group of "Invertebrated Vertebrates," but one genus—the *Amphioxus branchiostoma*—has yet been recognised, though several more or less doubtful species of the genus from various parts of the world have been described. Dr. Peters has received from Australia several examples of a well-marked, though closely-allied, form, which he names *Epigomethys cultellus*, and which differs from *Branchiostoma* in having a high dorsal fin and in wanting the caudal and anal fins. These minute rarities were dredged up near Peale Island, in Moreton Bay, in eight fathoms water.

A New Peripatus.—A paper on *Peripatus*, by Capt. F. W. Hutton, Director of the Otago Museum, which will be found to be a valuable supplement to that by Mr. H. Moseley, in the *Transactions* of the Royal Society, has been published in the current number of the *Annals and Magazine of Natural History*. The author describes a new species, which he names *Peripatus novæ-Zealandiæ*, peculiar in being hermaphrodite. These strange animals, between 1 and 2 inches in length, are found in the West Indies, Chili, the Cape of Good Hope, and New Zealand. They have relations with worms and with the tracheate Articulata, and habits much like those of the wood-louse.

The Persian Deer.—In the same number of the same journal, Dr. N. Severtzoff has also an interesting communication on the affinities of the Persian Deer (*Cervus maral*), in which he shows that this species is identical with the Wapiti (*C. canadensis*) of Canada, that from the warmer locality changing colour in the summer, that from the colder not doing so. The author very reasonably suggests that the name *C. wapiti* or *C. maral* would be preferable to *C. canadensis*, now the distribution of the species has been shown to be so general.

Fishes of the Aralo-Caspio-Euxine Basin.—The results arrived at by Prof. Kessler, after many years' study of the fishes of the Aralo-Caspio-Euxine region (which includes these three interior seas with their affluents) are as follows:—The number of described species is about 280, out of which 80 are marine, 100 fresh-water, and 40 brackish water species; 20 inhabit various waters, and 40 are migratory. 150 species belong exclusively to the region, and 10 have spread out into neighbouring regions at comparatively recent times. Out of the 120 other species, about 25 have a wide range of distribution, about 80 have migrated into the Black Sea from the Mediterranean, and about 15 fresh-water species have penetrated into the Aralo-Caspio-Euxine region from the north. Out of the 160 species limited exclusively to this region, 45 were found in the Black Sea, 54 in the Caspian, and 26 in Lake Aral. There are but 6 species which inhabit simultaneously the three basins of the three interior seas, 4 species which are common to the Caspian and Aral basins, and 25 to those of the Black Sea and the Caspian. The most characteristic families of fishes in the region are the *Gobioidæ* and the *Acipenseridæ*, the former being represented by r ɔ less than 50 species, out of which 40 do not extend over other regions; the genus *Benthophilus* of this family, which numbers here six or seven species, has no representatives abroad; and the genus *Scaphirynchus*, represented in the Amu and Syrdarya by three species, is known to have but one more species inhabiting the Mississippi.

Development of the Mamma.—Among the important histological investigations which have appeared quite recently in one by Mr. C. Creighton, M.B., in the current number of the *Journal of Anatomy and Physiology*, on the development of the mamma, and of the mammary function, in which the view generally received that the mamma is a complex extension downwards of the ectoderm or surface of the skin, is combated in favour of the

account originally given by Goodsir, that the essential secreting structure of the breast develops from a matrix tissue at numerous scattered centres, which are the same from which the surrounding fat originates, and that the ducts arise out of the same matrix tissue by direct aggregation of the embryonic cells along predetermined lines. It is shown that in neither genus of Monotremata does the mamma possess a duct-system, it simply being a follicular gland. In the Cetacea these follicles open into a median unbranched simple duct. In the Marsupials and all other animals the ducts are branched, which causes the organ to be racemose. It may be noted that it was during the prosecution of this investigation that Mr. Creighton was led to the correct determination of the nature of the coagulation-appearances found in mucus and other albuminous fluids.

NOTES

WE regret to announce the death, at Stuttgart, on the 5th inst., of the celebrated traveller and zoologist, Theodor von Heuglin. He was only fifty-two years of age, having been born in 1824, at Hirschlanden, near Leonberg, in Suabia. Von Heuglin had received a comprehensive education and had well prepared himself for his greater travels, by numerous visits to different European countries and by wide study. In 1850 he made a protracted stay in Egypt in order to study oriental languages, manners, and customs. After some visits to the interior of Arabia as well as the east coast of the Red Sea, he became secretary to Dr. Reitz, the Austrian Consul at Khartoum, and in that capacity visited the Upper Nile districts and Abyssinia. When Dr. Reitz had succumbed to the climate, von Heuglin returned to Khartoum, and succeeded him in the consulate. As consul he visited the White Nile, and eventually returned to Germany in 1856. Here he published his excellent "Travels in North-East Africa" (Gotha: Justus Perthes, 1857), which had been preceded (in 1855) by his "Systematic Review of the Birds of Africa." He again paid a visit to the Red Sea, and in 1860 took the lead of the expedition which was to find Vogel's traces, proceeding from the east; Steudner, Kieselbach, Hansal, Schubert, and Munzinger were members of this expedition, which, although acquiring valuable information about the Gallas districts, failed in its principal object. In 1862 von Heuglin returned to Khartoum with Steudner, and in 1863 made a fresh attempt to trace the course of the White Nile. The results of these travels were published in Petermann's *Mittheilungen* (1860–64). His merits were particularly great in ornithology; his drawings are true to nature, his descriptions exact, detailed, and extremely attractive. Also in Arctic regions von Heuglin gave proof of great intelligence and courage; he was almost more successful as an Arctic explorer in 1870 and 1871 than as an African traveller. His work on northern landscapes and animals (published by Westermann, at Brunswick) is one of the most attractive and handsomest records of travels yet published, and is highly esteemed by all who are interested in Arctic exploits. His death was a sadly unexpected one, a slight cough developed into inflammation of the lungs, to which he succumbed in the course of a few days.

WE deeply regret that we have to record the death of Mr. T. Heathcote G. Wyndham. Few among the younger men devoting their life to the pursuit of scientific knowledge and to the teaching of science have formed for themselves a higher ideal of the training a man of science should impose on himself before venturing on original work, or on giving instruction to others. As a commoner of Oriel he took a first class in natural science in 1866, was Burdett-Coutts Scholar in 1867, and was afterwards elected Fellow of Merton. He undertook at Merton the duty of a lecturer in natural science, and the thoughtful care he took in his teaching was not only gratefully spoken of by many of the undergraduates, but frequently referred to in conversation by those who knew him. The branch of natural science which seemed gradually to have presented itself more prominently to his mind for his own especial study was the chemical side of mineralogy. But although for years he fitted himself for this work in all ways he thought requisite, sparing no pains in acquiring collateral knowledge that might bear on his subject, and though he had done original research which many other men would from time to time have thrown off in isolated papers, he held back from appearing in print. A paper on Idocrase and Garnet and one on Vesuvius are, so far as we know, all he published. But there is a prospect that some of his work will be preserved, as in conjunction with Mr. Gurney he had in hand a small work on chemical mineralogy. Although he had not yet achieved work to make his name marked in the world of science, yet those who knew him lament the loss of a scholar and a gentleman, and the lament is in no way softened by the unhappy circumstances attending his death.

THE published results of the exploration of Lake Titicaca by Messrs. Alexander Agassiz and S. W. Garman, has just reached us. The expedition was undertaken during the early months of last year. Mr. Agassiz writes on the hydrography of the lake, describing the peculiarly uniform temperature at all depths, the potability of the water, the scarcity of the fish—six species only—and its previous greater extent. Mr. J. A. Allen gives a list of the mammals and birds collected, with field-notes by Mr. Garman. Of mammals only ten species were obtained, none new, four being Llamas. Of birds sixty-nine species were collected, including a new *Falcinellus* (*ridgwayi*), and a Gallinule (*Gallinula garmani*) closely resembling *G. galeata*. It is noted that many of the species had been but a short time before obtained by Messrs. Bartlett, Whitely, Hauxwell, and Jelski, and described by Messrs. Sclater and Salvin, Cabanis and others. Mr. W. Faxon describes the Crustacea, all excepting a species of *Cypris*, belonging to one amphipodous genus *Allorchestes*, of which seven new fresh-water species are added to the one or two already known. Mr. Agassiz gives a valuable hydrographical map of the lake, and records the presence of corals closely allied to genera living in the West Indies at the height of 2,900 feet above the level of the sea.

MESSRS. CHURCHILL have just published a third edition of Mr. Sutton's "Systematic Handbook of Volumetric Analysis," in which the author has embodied "all such novelties and modifications as experiment have proved to be worthy of notice."

WE have to announce with great regret the death of another martyr to science. In a letter, dated September 15, the Rev. S. McFarlane writes from Somerset, Cape York: "We have just heard of the massacre of Dr. James and his partner, a Swede, at Yule Island by the natives of New Guinea. They had gone in their large boat to the east side of Hall Sound to shoot birds of Paradise, when they were attacked by three canoes, and both white men were killed. The native crew managed to get away in the boat, and brought the sad news here." Dr. James was a young American who had been collecting objects of natural history in Yule Island and on the opposite shores of New Guinea. His first collections arrived in this country about a fortnight ago, having been sent over by his friend, Dr. Alfred Roberts, of Sydney, to whose liberality the expedition was greatly indebted. The excellent way in which the specimens are preserved and the careful notes given by the collector show that Dr. James was enthusiastic in his work, and it is melancholy to think that so promising a scientific career has been thus prematurely cut short. A description of the collection of birds formed by the late traveller will be given by Mr. Bowdler Sharpe at an early meeting of the Linnean Society, in continuation of the articles on the

avifauna of New Guinea, commenced during the last session of the Society.

THE Forty-seventh Session of the Royal Geographical Society was opened on Monday evening by the delivery of the presidential address by Sir Rutherford Alcock. He referred to the satisfactory state of the Society, which now numbers 3,199 members, and to the valuable work it had done since its foundation for the cause of geographical research. He also referred with complete satisfaction to the work accomplished by the Arctic expedition, the leaders of which had done the only thing that could have been done under the circumstances. Sir Rutherford then spoke of the work of Cameron in Africa, the *Challenger* Expedition, Russian Exploration, the Oriental Congress, and on various other topics. He referred to the fact that geography and exploration have now assumed a much more scientific aspect than ever they had before; no traveller can gain distinction by mere topographical detail and descriptive power; his exploration must be conducted on a thoroughly scientific basis. To spread a knowledge of this aspect of geography, lectures are to be given during the winter by General Strachey on the general subject of "Geography in its Scientific Aspect," Dr. Carpenter on "The Physical Geography of the Ocean," and Mr. Wallace on "The Influence of Geographical Conditions on the Comparative Antiquity of Continents, as indicated by the Distribution of Living and Extinct Animals." After the President's address, Sir R. Douglas Forsyth read a paper on "The Buried Cities of the Gobi Desert."

THE Lords of the Admiralty have addressed a letter to the Commander-in-Chief at Portsmouth, in which they request Admiral Elliott to express to Capt. Nares their lordships' warm approval of the conduct of all engaged in the Arctic Expedition. While they deeply commiserate the sufferings of the officers and men, and deplore the loss of life, they cannot but feel that their bearing and conduct have been in all respects worthy of British seamen. Their lordships approve the sound judgment displayed by Capt. Nares in at once, on the return of his sledge parties, determining to endeavour to extricate the ships and return to England, and they observe that his skill and energy in carrying out this determination, ably seconded as he was by Capt. Stephenson, were of the highest order. Capt. Nares proudly records that to uphold British honour and Christian duty to the death was the pre eminent determination of all under his command.

A SPECIAL Arctic meeting will be held under the auspices of the Royal Geographical Society at St. James's Hall on December 12, when papers on the various results of the English Arctic Expedition will be read by Captains Nares, Markham, and Feilden.

AMERICAN observatories have been very diligent in the search for the supposed "Intra-Mercurial Planet," no less than nine having given their whole time to the search on October 2, 3, 10, and 11, viz., those of Dartmouth College, Harvard College, Cincinnati, Glasgow (Mo.), Washington, Albany, the Coast Survey in San Francisco, Ann Arbor, and the Observatory of Dr. Peters, besides others that have made no report. It is exceedingly creditable to the United States that they contain so many observatories, many of them national ones, in which astronomical observations are so diligently pursued.

THE Free Spanish University we referred to in vol. xiv. p. 132, has been opened in Madrid, under the name of Free Institution of Education, for Government will not allow the assumption of the title University. Only 1,000 guineas have been subscribed, many of the shareholders being well-known Englishmen, among them Prof. Tyndall. The Institution is held at present in one storey of a large house, and has already seventy-three students, besides eight or nine ladies; the fees are very low. We hope this attempt to establish a university where unrestricted instruction can be given, will prosper, and that the professors, all men of high standing, will soon be able to have a building of their own.

THE library of the late Adolphe Brongniart is to be sold by auction in Paris on December 4, and following days. The classified catalogue, arranged by M. Deyrolle, occupies 240 pp. 8vo. Copies may be obtained through M. Deyrolle, 23, Rue de la Monnaie.

THE *Kölnische Zeitung* of November 9 reports on a meeting of the Rhenish section of the German and Austrian Alpenverein, held at Cologne on November 4. It appears that the Verein, the head-quarters of which are at Frankfurt-on-the-Maine, consists of sixty sections and numbers over 6,000 members. During 1875 over 2,000*l.* were expended for the construction of huts and roads in the Alps, and the Verein now owns about twenty-four houses in different parts of the mountains; it has also appointed a special commission for the supervision of guides and huts. Altogether the Verein is thriving, and we may look for important scientific results from its labours.

IT is stated that M. Gessi has discovered a large branch of the Nile, 200 yards wide, with a good current, diverging from the White Nile, 100 miles south of Duffle. It is stated by the natives that it runs in an unobstructed stream into the Nile again, and, if so, water communication may possibly be established between Lake Albert Nyanza and Khartoum. Col. Gordon has discovered a large lake fifty miles in length between Urondogam and Mrooli, a little north of Victoria Nyanza (in 1° N. lat.), from which issues the main branch of the Nile, called Victoria Nile, running from the Victoria to the Albert Lake, together with a branch river which must either join the Sobat river or the Asua river.

THE Italian geographical journal, *Cosmos*, for October contains a continuation of the papers on New Guinea, which it has made a specialty. The present contribution consists of further letters from Dr. Beccari and extracts from the *Challenger* reports.

TO the November number of Petermann's *Mittheilungen*, Lieut. Weyprecht contributes No. 7 of his "Bilder aus dem hohen Norden," under the title of "The Walrus-Hunter." He describes in a graphic and interesting manner the yearly quest of the walrus-fishers in the Spitzbergen Seas, which is becoming more and more difficult and dangerous on account of the increasing scarcity of the animal.

THE Geographical Society of Paris has received news from the Brazza-Marche expedition, now exploring the Ogove, the large stream which falls into the South Atlantic in the French African settlement of Gaboon. It was discovered by the explorers that, after running north to the first degree of S. lat., the Ogoive turns abruptly southwards into quite unexplored regions. MM. Brazza and Marche had lost almost all their goods destined to conciliate the African tribes and to pay for their labour. But the Society sent to them a large number of small objects which will enable them to proceed towards the sources of the river. It is supposed that, owing to the immense volume of its water, it is an outlet for some of the large lakes of the yet untrodden region.

A TELEGRAM from Calcutta states that the district of Backergunge was ravaged by a cyclone on the 1st inst. Thousands of native houses were destroyed. The town of Dowlutkhan was submerged by a storm-wave, which swept away all the buildings of the place. Five thousand persons are believed to have perished. Backergunge is a British district in the Bengal presidency, near the mouth of the Ganges, lying between lat. 22° 2′—23° 13′., long. 89° 49′—91°, and has an area of about 3,794

square miles. A severe cyclone has also been experienced at Chittagong.

THE *Kölnische Zeitung* of November 11 reports on a disastrous gale and snowstorm which raged with terrific force in the neighbourhood of Stockholm on the 5th inst. Over fifty vessels stranded near Kalmar, and all railway lines to the south and to Norway were completely snowed up, and traffic upon them interrupted. The latter had not yet been resumed on the 8th inst.

A MAGNIFICENT bolide was observed on Sunday night, November 5, at nine o'clock, at Clerey (Aube), in France. Numerous sparks were visible and an explosion was heard, although very feeble, owing to the immense distance at which it had taken place.

THE French Minister of the Interior has authorised the Municipal Council of Lyons to dedicate a bust to Ampère, the inventor of electro-magnets. This memorial will be placed in the museum where are gathered the memorials of the illustrious men who were born in the city.

THE transit-room in which the Bischofsheim instrument is to be placed is being fitted up at the Paris Observatory. The work is almost finished. M. Leverrier has asked the Minister of Public Instruction to appoint an administrative commission in order to better regulate the part which the Observatory is to take in the 1878 Exhibition.

THE new number of the *Ibis*, now in the press, will conclude the third series and the eighteenth volume of this ornithological periodical, which has been carried on by the British Ornithologists' Union with the greatest energy since its institution as the organ of that body in 1859. A fourth series, under the joint editorship of Messrs. Salvin and Sclater, will be commenced next year.

COUNT T. SALVADORI, of the Royal Zoological Museum of Turin, is engaged on a general account of the birds of the Papuan and Molluccan Islands, based principally on the large collections recently formed by the Italian naturalists Beccari and D'Albertis in those countries. The work will be published, when completed, in the *Annals* of the Museo Civico di Storia Naturale of Genoa, to which institution the above-named collections have been transmitted.

ON Thursday and Friday last week the Haggerstone Entomological Society held its annual exhibition at its place of meeting, No. 10, Brownlow Street, Dalston. It was only in 1857 that a few working men interested in insect-collecting discussed, in West Wickham Wood, the desirability of an east-end club for mutual assistance. A club was formed and now numbers a hundred members. The subscription is but a penny a-week, but with this a reference library has been accumulated. The type cabinet for the collections consists of forty drawers, in which there are now some 15,000 specimens, and the library and collection together are insured for 200*l*. All through the year the society meets every Thursday, and many points of practical importance (some of them bearing on "the theory of evolution" put to the test by breeding) have been discussed. Among the ways in which members of the society have done valuable work may be mentioned the preservation of the avenue of elms in Victoria Park from insect ravages by a knowledge of exactly how to proceed in dealing with the foe. Although this and several such societies do not obtrude themselves on the scientific world, they still, besides exercising a good effect on the members, often do work of sterling value.

WE understand that it is proposed at University College to give a larger development than before to the practical work of students in connection with the classes of mathematics, physics, and engineering in their workroom especially adapted to the purpose, and placed under the direction of a special teacher, M. Paul Robin. Various models to illustrate the theorems of modern and higher geometry, of kinematics and mechanics, so difficult to understand theoretically,—such models as are so largely represented in the South Kensington Exhibition collection—will be made in a simple manner by the students themselves, side by side with their theoretical studies. The best models, and such as require more time and accuracy for their construction, will be preserved in a small educational collection. It would hardly be possible to insist too strongly on the usefulness, or rather on the absolute necessity of such work for the successful study of science. It is only when the student has not only seen and handled various practical illustrations and applications of the theorems of geometry and mechanics he is studying, but when he has himself constructed them—however roughly approximate they may be—that the mathematical truths will be permanently impressed on his mind. Only thus can he become so familiar with them, that they will be a basis for acquiring further notions, and a source of further mental activity. We wish, therefore, complete success to this new enterprise of University College.

SHORTLY after the appearance of Prof. Tyndall's work on Glaciers, the Bologna Professor, Bianconi, observed that, while Tyndall's experiments certainly prove that rapid changes of form in ice are due to crushing and to regelation, they do not prove at all that ice is devoid of a small degree of plasticity, which degree might be sufficient to explain the plasticity of glaciers. He undertook, therefore, a series of experiments (described and published in 1871 in the *Mem.* of the Acad. of Bologna, 3rd ser. vol. i.) on planks and bars of ice submitted to bending and torsion. The bending of ice-planks having been afterwards the subject of researches of Messrs. Mathews, Moseley, Tyndall, and Heim, it will suffice to say that Prof. Bianconi, making his experiments at higher temperatures (from + 1° to + 5° Cels.), observed a still greater plasticity of the ice than that obtained by the experiments made in England and Germany at lower temperatures. These experiments proved that slow changes of form of the ice may go on without any crushing and regelation, and that ice enjoys a certain degree of plasticity notwithstanding its brittleness; the ice-plank can, indeed, be shattered to pieces, during its bending, by the slightest shock. Now, Prof. Bianconi gives in the *Journal de Physique* for October the results of his further experiments on ice, much like those of Heim, or, yet more, those of M. Tresca on the puncheoning of metals. Granite pebbles and iron plates are slowly pressed into ice at the same temperatures, and not only do they penetrate into it as they would penetrate into a fluid or semi-fluid, but also the particles of ice are laterally repulsed from beneath the intruding body, and form around it a rising fringe. Moreover, when a flat piece of iron is pressed into the ice, the fringe rising around it expands laterally upon the borders of the piece, and tends thus, as in fluids, to fill up the cavity made by the body driven in. These experiments tend thus greatly to illustrate the plasticity of ice; but it would be very desirable that M. Bianconi, if he continues his researches, should accompany them by some measurements (as has already been done by M. Heim) in order to obtain numerical values of the plasticity of ice under various circumstances.

AT the Warsaw meeting of Russian naturalists Prof. Mendeléeff described the results of researches he has pursued during 1875 and 1876 for the verification of Mariotte's law. His former researches had proved that the decrease of volume of the permanent gases proceeds at a slower rate than the increase of pressure exerted on them, if the pressure is less or much greater than the mean pressure of the atmosphere. The experiments of Regnault, made with air, nitrogen, &c., at pressures higher than

that of the atmosphere proved, however, directly the contrary, and a series of measurements undertaken some years ago by Prof. Mendeléeff to verify those of Regnault, gave the same results. Suspecting that there might be some cause of error affecting in the same way both series of experiments, Prof. Mendeléeff and M. Bogussky constructed special apparatus eliminating all possible causes of errors and allowing the most perfect accuracy of measurements. With these they made a new series of researches, at pressures varying from 700 to 2,200 millimetres. These researches confirmed again the conclusions of Regnault, showing only numerical differences in the values obtained, and proving, for instance for the air, that its deviations from Mariotte's law are even less than appeared before. But the most important result of the researches is that the divergences from Mariotte's law shown by the air being negative at pressures above the mean atmosphere, as was observed by Regnault, proved to be positive (decrease of volume slower than the increase of pressure) at pressures below it. We must then conclude that the air experiences a change of compressibility at a certain pressure about the mean of that of the atmosphere; and this conclusion is supported by the circumstance that such a change was noticed also in the carbonic and sulphurous acid gases, but at pressures far lower than is the case for air. Only for hydrogen the divergence is of the positive kind at all pressures. Altogether we must conclude that the deviations from Mariotte's law are far more complicated than has been suspected.

AT the same meeting Prof. Czehovicz demonstrated the influence exercised by various sources of electricity on certain spectra, chlorine, oxide of carbon, &c. The inductive apparatus of Ruhmkorf gives a spectrum differing from that produced by the Holtz electric machine, not only by the number of rays, but also by their position and aspects. Prof. Czehovicz proposes therefore to make for comparative researches a selection of such rays as maintain the same aspect and occupy the same position whatever source of electricity be used; such lines will not be numerous.

AT the same meeting Prof. Grewingck presented the drawing of his geological map of the Baltic provinces, prepared for a second edition. It embodies the results of all acquisitions made in this department during the last fifteen years, and will soon be published.

THE Warsaw Zoological Museum having received during recent years valuable additions from America, Africa, and Eastern Siberia, presented by Count Branicky, is now very rich in the department of higher animals. It counts 514 species of mammalians, 3,216 of birds, and 400 of reptiles and amphibians.

THE Natural Science Club at Cambridge held several successful meetings during the two months' residence in the Long Vacation. The following papers were read:—"Hæckel's Gastræa Theory," by Mr. Marshall (St. John's); "Fermentation," by Mr. Stolart (St. Peter's); "Some Salts of Chromium," by Mr. Houghton (St. John's); "The Relation between the Fore and Hind Limbs of Vertebrates," by Mr. Phillips (St. John's); "Growth," by Mr. Buxton (Trinity); "Theories of Heredity," by Mr. Sedgwick (Trinity); "Owen's Vertebrate Theory of the Skull," by Mr. Humphry (Trinity); many of which were followed by interesting discussions and remarks.

A GERMAN paper describes a dreadful fight between two Polar bears, male and female, in the Cologne Zoological Gardens. After a fierce struggle the female became exhausted, and was dragged by the male into the water basin in the den, and held down till life was quite extinct. He then pulled her out and dragged the body for a considerable time round the den.

FROM a correspondence in the *Times* we learn that the statue of Faraday, subscribed for years ago, and entrusted to Foley to execute, was left by that sculptor in the clay at his death. Since then, Mr. Burch, the principal pupil of Foley, has been entrusted with the founding and completion of the work.

THE second edition of Brehm's well-known "Thierleben" is about to be published in 100 parts, with entirely revised text and with almost entirely new illustrations taken from life.

AT the meeting of the Mathematical Society, on November 9, the changes were made which we intimated in vol. xiv. p. 581.

PART 5 of the second series of the great work, in quarto, upon the butterflies of America, with coloured drawings and descriptions, has just been published by Mr. Edwards, through Hurd and Houghton, New York, and sustains the reputation of its predecessors by the artistic elegance and superiority of its illustrations. These consist of five plates, executed by Miss Peart in her best style, giving, for the most part, not only the different sexes and varieties of the adult insects, but likewise the eggs, larvæ, and chryssalides, and the favourite plants upon which they feed. No new species are represented, although several of those included are of great rarity.

THE *City Press* states that some of the Livery Companies have a scheme in embryo for combining to form a College of Technical Instruction in a building to be erected on the Thames Embankment.

THE Board for superintending non-collegiate students give notice that an examination in physical science for the award of an exhibition of 50*l.* a year, granted by the Worshipful Company of Clothworkers, and tenable for three years by a non-collegiate student, will be held in the Censor's rooms, 31, Trumpington Street, Cambridge, commencing on Thursday morning, December 14, 1876, at 9 o'clock. Fuller information as to the subjects of examination and the conditions of tenure of the exhibition may be obtained from the Censor, Rev. R. B. Somerset, Cambridge.

A CAUCASIAN Society of Naturalists has been recently opened at Tiflis.

THE publishing house of Trübner in Strasburg are issuing translations of Macmillan's Science Primers, under the superintendence of the Professors of the University. There have already appeared Roscoe's Chemistry and Balfour Stewart's Physics, the former by Prof. Rose, and the latter by Prof. Warburg, Lockyer's Astronomy, by Prof. Winnecke, and Geikie's Physical Geography, by Prof. Oscar Schmidt, are in the press.

THE *Augsburger Allgemeine Zeitung* of November 5 gives some interesting details of the North-Dutch canal, which was opened officially by the King of Holland on the 1st inst., and which connects the city of Amsterdam directly with the German Ocean. It appears that the canal is 25 kilometres in length, that at its broadest part it measures 120 metres across its surface by 68 metres at its narrowest part. In the middle the depth averages 6 metres, but during the next two years the depth is to be made uniform all over the area of the canal, and to be increased to 8·20 metres, so that even the largest vessels can come close to the quays on both sides of the canal. Its name is to be Ymuiden, viz., mouth of the Y; at the spot where it reaches the sea two enormous moles or dykes have been constructed, reaching 1,600 metres into the sea, and forming a spacious port of refuge for ships during stormy weather; their extreme ends are no less than 1,200 metres apart. The total cost of the canal, which was borne by the Dutch Government as well as by the city of Amsterdam, amounted to more than twenty-six millions of florins, and it is expected that about seventeen millions more will be wanted for the construction of quays, warehouses, &c.; yet the

undertaking cannot fail to be a success, owing to its incalculable importance with reference to the commerce of Amsterdam.

THE following experiment has recently been employed by M Merget to demonstrate the phenomena of gas-synthesis in plants: Two glass cylindrical vessels of 300 cc. capacity are placed with their open ends in a large vessel of water. The one is filled with hydrogen, the other with oxygen, their interiors are brought into communication by means of a branch which is long enough to reach from one end to the other. The level of the water is seen gradually to rise in each cylinder, and both gases finally disappear, without, however (as other experiments show), condensation or displacement being produced. At the beginning of the experiment there is nearly equality in the volumes which disappear, since a part of the oxygen serves to form carbonic acid; but in proportion as the water level rises in the two cylinders, and the projecting parts of the branch become shorter, the disappearing volume of hydrogen becomes more and more nearly double that of the oxygen. If a similar experiment be made with hydrogen and nitrogen in the two vessels, the disappearing volume of the gas is to that of the latter as three to one. Operating with hydrogen and carbonic oxide, both gases always disappear, but in very variable proportions. The most common was one volume hydrogen to one volume carbonic oxide, but the ratios of 4 : 1 and 5 : 1 were also sometimes met with. M. Merget finds in these variations the indication of a formation of hydrates of carbon, and of various carburets of hydrogen.

IT is pretty generally supposed that crystallised nitroglycerine is considerably more sensitive to shocks and blows than the liquid substance, though there is nowhere evidence of this; and not only is practical experience against it, but from the theoretical standpoint it seems very improbable, for by reason of the positive melting heat of crystallised nitroglycerine, a considerable amount of heat must be employed to change its aggregate state before an explosion can occur. For decision of this question M. Beckerhinn (of the Vienna Academy) recently used a fall-machine furnished with a block of wrought iron 2·130 kilogrammes in weight, having at its lower end a hardened steel point of 7·068 sq. mm. A flat anvil of Bessemer steel was employed as support for the nitroglycerine, which was placed on it in a thin layer, and the weight dropped upon it from different heights. It was found that the mean height of fall with which explosion of the liquid occurred was 0·78 metres, whereas the frozen nitroglycerine did not explode till a fall-height of 2·13 m. was reached, showing that the frozen substance is considerably less sensitive to impact. M. Beckerhinn has determined some constants of the solid material. The average melting heat (from three experiments) appeared to be 33·54 heat-units. The density was found = 1·735 (the determinations were made at a temperature of + 10° C., which is near the melting-point of nitroglycerine); that of the liquid material was 1·599, whence it appears that in crystallising of nitroglycerine there is a contraction of about $\frac{10}{121}$ of the original volume.

AMONG the various works presented at the last Congress of Orientalists we notice a very useful catalogue, "Bibliographia Caucasica and Transcaucasica," by M. Miansaroff, the first volume of which recently appeared in St. Petersburg. It is the result of fifteen years' labour by the author and of careful research pursued by him in the chief libraries of Russia, Germany, Italy, and Turkey. The work is divided into three parts, devoted respectively to the Earth, to Man, and to the Mutual Influences of Nature and Man. The first two form the first volume (800 pages in 4to), which contains more than 5,000 titles of books and smaller papers on the Caucasus and Transcaucasus which have appeared in Europe and Asia since A.D. 1565. They are systematically arranged under the heads of geodesy, cartography, physical geography and geographical descriptions of localities, geology, botany and zoology, mineral springs, climate, medicine, &c. Whatever be the imperfections of this work, or of the classification adopted in it, it will nevertheless prove most useful for all engaged in the study of Caucasus.

DR. KING'S report of the Royal Botanical Gardens, Calcutta, for the year 1875-76 has just reached us. In the acclimatisation of valuable economic plants in India, the Calcutta reports have become of late years the official record, and the present report by no means lacks interest on this score, though it is unsatisfactory to find that Dr. King's opinion is still against the possibility of either india-rubber or vanilla becoming staple products of Bengal. With regard to rubber plants both of the Para and Madagascar kinds, he says that during the year it has become more apparent than ever, that neither of these valuable plants can be grown for commercial purposes in the climate of Bengal. In the gardens as well as in the warm tropical valleys of the Sikkim Himalayas both kinds failed. Dr. King suggests that a suitable home may be found for them further north than Tenasserim, Ceylon, or perhaps Malabar. Vanilla, of which a number of plants were put out in the garden under shading similar to that used for protecting the pepper plants, has not made satisfactory growth, which it is suggested may have been due to overshading, and a further experiment has been made by planting many of them under the shade of mango trees. The finest old vanilla plants in the garden are described as growing against a north wall; this year one of these plants was laden with pods, but an unusually high temperature caused these to drop prematurely. A better report is given of the ipecacuanha; numbers of plants have been sent from Calcutta to Ceylon, to the Neilgherries and to Burmah, and the quality of those grown in India is said to be equal to the best native Brazilian growth. A good deal of attention has been directed lately to the bamboo as a source of paper-making material, and it has been thought that it might be cultivated with profit in India for this special purpose, the young tender shoots being reduced to a rough kind of paper-stock for convenience for transmission to England. Dr. King points out that if the old stem would answer the purpose there is plenty of material in India, and a large revenue would accrue, but the young shoots are only produced at a certain season; nevertheless, experiments are being made with a view to utilise the bamboo for this purpose. In the distribution of plants and seeds, we learn that no less than 23,106 plants, and 6,343 parcels of seeds, were sent out during the year. It is satisfactory to know that amongst Dr. King's other multitudinous duties he has found time to prepare a "Manual of Cinchona Cultivation," and to edit other works on Indian botany. We also learn that Mr. Kurz's "Forest Flora of Burmah" is passing through the press.

PART 3 of vol. i. of the *Proceedings* of the West London Scientific Association has been published, and contains several interesting papers and accounts of excursions.

THE October part of the *Journal* of the Franklin Institute contains an interesting history of the steam-engine in America.

MESSRS. WILLIAMS AND NORGATE send us the following German scientific works:—"Bilder aus Aquarium," by Dr. Hess, of Hanover; and "Grundriss der Zoologie," by Dr. Gustav von Hayek.

THE additions to the Zoological Society's Gardens during the past week include two Esquimaux dogs (*Canis familiaris*) from the Arctic region, presented by Capt. Allen Young, S.S. *Fandora*; four Viscachas (*Lagostomus trichodactylus*) from Buenos Ayres, presented by Mr. C. F. Woodgate; two Banded Ichneumons (*Herpestes fasciatus*) from West Africa, presented by Mr. W. N. Bakewell; three Chirping Squirrels (*Tamias striatus*)

from North America, presented by Mr. F. W. Stockwell; a Peregrine Falcon (*Falco peregrinus*), European, presented by Mr. Chilton Newburn; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Miss Ridsdan; three American Red Foxes (*Canis fulvus*), a Golden Eagle (*Aquila chrysaëtos*) from North America, six Clapperton's Francolins (*Francolinus clappertoni*) from West Africa, deposited.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, Nov. 2.—Prof. Abel, F.R.S., president, in the chair.—The President announced that the Goldsmith's Company had contributed 1,000*l.* to the recently-instituted research fund of the Society.—Mr. Lupton then read a paper on the oxides of potassium, after which communications were read on certain bismuth compounds (Part III.), by M. M. P. Muir.—On phospho- and arseno-cyanogen, by W. R. Hodgkinson.—A secondary oxidised product found during the reduction of stannic ethide to stannous ethide, by W. R. Hodgkinson and G. C. Matthews; and a preliminary notice on pigmentum nigrum, the black colouring matter contained in hair and feathers, by W. R. Hodgkinson and H. C. Sorby. This black colouring matter is left on digesting the coloured hair or feathers with dilute sulphuric acid, but is present only in very small quantity.

Zoological Society, November 7.—Prof. Newton, F.R.S., V.P., in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the months of June, July, August, and September, 1876.—A letter was read from Dr. Otto Finsch, relating to the supposed existence of the Wild Camel (*Camelus bactrianus*) in Central Asia.—A letter was read from Mr. E. Pierson Ramsay, giving a description of the habits of some *Ceratodi* living in the Australian Museum, Sydney, which he had lately received from Queensland.—Mr. W. K. Parker read a memoir on the structure and development of the skull in the sharks and rays.—Prof. A. Newton made a correction of some of the statements in Canon Tristram's "Note on the Discovery of the Roebuck in Palestine." (P.Z.S., 1876, p. 421).—Lieutenant-Colonel Beddome gave the description of a new species of Indian Snake from Manantawaddy, in the Wynaad Hills, which he proposed to name *Platyplectrurus hewstoni*.—Dr. G. E. Dobson, communicated a monograph of the Bats of the group *Molossi*.—Dr. A. Gunther, F.R.S., read a report on some of the recent additions to the collection of mammalia in the British Museum, amongst the more remarkable of which was a new form of Porcupine, from Borneo, proposed to be called *Trichys lipura*, and a new Marmozet, obtained by Mr. T. K. Salmon, near Medellin, U.S. of Columbia, to which the name *Hapale leucopus* was given.

Royal Microscopical Society, Nov. 1.—H. C. Sorby, F.R.S., president, in the chair.—A paper by Dr. G. W. Royston Pigott on a new refractometer was read by the President and illustrated by drawings and by the instrument removed for the occasion from the Loan Collection at South Kensington.—A paper by the Rev. W. H. Dollinger, on experiments with sterile putrescible fluids exposed alternately to an optically pure atmosphere and to one charged with known organic germs, was read by the Secretary.—A paper by Mr. F. H. Wenham, on the measurement of the angle of aperture in object glasses, was read by Mr. Ingpen.

PARIS

Academy of Sciences, November 6.—Vice-Admiral Paris in the chair.—The following papers were read:—On an experiment which should be made with a view to the destruction of phylloxera, by M. Em. Blanchard. He advises a general adoption of the method of "coating" the vines and stakes in winter with coal tar, so as to destroy the eggs lodged in the fissures or under the bark.—Reply to M. Balbiani with regard to migration and egg-laying of phylloxera, by M. Lichtenstein. It is the nutriment and not the interior conformation of the insect that produces the fecundity. M. Lichtenstein does not accept the theory of degenerescence or exhaustion of the females.—Letter to M. Dumas on the products of the winter egg of *Phylloxera vastatrix*, by M. Boiteau.—M. Mouillefert presented some photographs showing the efficacy of treating phylloxerised vines with sulphocarbonate of potash.—On the efficacy of iodides against saturnine intoxication, by M. Faure. He considers that a workman taking 5 to 10 centigrammes of iodide of iron or of potassium daily will have satisfactory results, and not be forced to interrupt his work.—On the results obtained by illumination of photographers' studios with violet light, by M. Scottelari. Violet light acts more rapidly than white or blue, and so requires shorter exposure. Some persons are very impressionable to ordinary light, but not to violet rays. The photographs got with violet rays are better modelled, and have a better finish.—M. Farret communicated results he has obtained in organisation of exercises for remedying Daltonism. These have been established in several schools, and he hopes to introduce them into the army and navy, railways, &c.—Researches on the production of electro-chemical deposits of aluminium, magnesium, cadmium, bismuth, antimony, and palladium, by M. Bertrand.—On a new dynamo-magnetic phenomenon, by MM. Trève and Durassier. A horseshoe magnet of any length is covered on one face with a varnish, or, better, a plate of glass. A cylinder of soft iron is laid on its neutral part. It commences to move towards the poles, and reaches them in a time which is naturally a function of the weight of the cylinder and of the coercitive force of the magnet. Thus the magnetic attraction is exerted over the whole extent of the magnet. A new mode is afforded of estimating the magnetic force by the mechanical work which it has effected. The product of the movable weight by the space traversed, divided by the time, will be the rigorous measure of this force. Determining the force, *e.g.*, for three large and three small magnets, identical in form and weight, containing respectively 0·250, 0·500, and 1 per cent. of carbon, the authors think it perhaps possible to define the unit of magnetic force, or *magnetic*, and to establish its equivalence in kilogrammetres. The phenomenon also helps them to determine the magnetic conductivity of steels in relation to their proportions of carbon.—Examination of urine for fuchsine, by M. Bouillon. He employs hydrate of baryta in excess. It decomposes perfectly the salts of rosaniline, precipitates the colouring matter of the urine, and furnishes, by filtration, liquids of ambreous colour, which do not give persistent emulsions with ether.—Contributions to the anatomy and histology of the echinida, by M. Fredericq. The nerves and muscles are described. The latter are formed of very thin cylindrical fibres, quite smooth and homogeneous throughout their length. Using various reagents, he could not detect the least trace of transversal striation. The fibres have a fibrillar structure, often with elongated nuclei applied on their surface, but they are without an enveloping membrane. They are birefringent, and are strongly impregnated with colouring matter and osmic acid. The muscles contract strongly under electric excitation, but not so suddenly as striated muscles.—Observation of a bolide, on the night of November 5, 1876, by M. Meunier. A fire-ball, the size of one's fist, was observed near α of Ursa Major; and behind, its trajectory south to north, was traceable as a luminous line, commencing near Capella. The flash was bluish, and appeared brighter than moonlight.

CONTENTS

	PAGE
FOSTER'S "ELEMENTARY PHYSIOLOGY"	53
BRITISH MANUFACTURING INDUSTRIES	54
LETTERS TO THE EDITOR:—	
Sea Fisheries.—Prof. ALFRED NEWTON, F.R.S.	55
The Foundation of Zoological Stations in Heligoland and Kiel.—Dr. ANTON DOHRN	57
The Deep-sea Manganiferous Muds.—EDWARD T. HARDMAN	57
Mr. Wallace on the Distribution of Passerine Birds.—W. A. FORBES	58
Antedon rosaceus (Comatula rosacea)—THOMAS R. R. STEBBING; ARTHUR ROOPE HUNT; PHILIP B. MASON	58
Meteor.—T. NOSTRO	59
THE MUSICAL ASSOCIATION. By Dr. W. H. STONE	59
ON THE RESISTANCE OF THE AIR TO THE MOTION OF PROJECTILES	60
A LOCAL MUSEUM. By J. SHAW	61
THE AUSTRIAN ARCTIC EXPEDITION (*With Illustrations*)	62
OUR ASTRONOMICAL COLUMN:—	
The Nineveh Solar Eclipse of B.C. 763	65
The Comet of 1652	65
The Brightness of Jupiter's Satellites	65
BIOLOGICAL NOTES:—	
The Progress of Embryology	65
New Species of Echidna	66
Sphenodon Guentheri	66
A New Fish	66
A New Peripatus	66
The Persian Deer	66
Fishes of the Aralo-Caspio-Euxine Basin	66
Development of the Mamma	66
NOTES	67
SOCIETIES AND ACADEMIES	72